PROCEEDINGS

Fifty-Seventh Annual Convention

OF THE

American Railway
Bridge and Building Association

1952

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Proceedings of the

Fifty-Seventh Annual Convention

of the

American Railway
Bridge and Building
Association

Held at

CHICAGO, ILLINOIS

September 15-17, 1952

Published by the Association
Elise LaChance, Secretary
431 So. Dearborn St., Chicago 5

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OFFICERS FOR 1952

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F. R. Spofford Boston & Maine, Dover, N.H.	First Vice-President
Lee Mayfield Missouri Pacific, Houston, Tex.	Second Vice-President
H. M. Harlow Chesapeake & Ohio, Richmond, Va.	Third Vice-President
J. A. Jorlett Pennsylvania, New York	Fourth Vice-President
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L. C. Winkelhaus Chicago & North Western, Chicago	Treasurer

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M. H. Dick, Railway Track & Structures	Chicago, Ill.
R. R. Gunderson, Southern	Washington, D.C.
J. F. Warrenfells, Seaboard Air Line	Savannah, Ga.

Terms Expire 1953

W. H. Huffman, Chicago & North Western	Chicago, Ill.
L. R. Morgan, New York Central	Detroit, Mich.
B. M. Stephens, Texas & New Orleans	Houston, Tex.

Past President

W. A. Huckstep, Missouri Pacific	St. Louis, Mo.

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G. Switzer, Western Pacific	Sacramento, Cal.

Past President

Guy E. Martin, Illinois Central	Chicago, Ill.

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PROCEEDINGS

This section contains a running account of the activities during the three-day annual meeting in 1952; brief abstracts of the addresses read to the joint sessions with the Roadmasters' Association; and all of the B. & B. committee reports, printed in full, with brief abstracts of the discussions that followed their presentation.

What with the presentation of eight comprehensive committee reports, the delivery of an informative and instructive address, and the viewing of a motion picture, those attending the sessions comprising the 57th annual meeting of the American Railway Bridge and Building Association had a busy time of it. As has been the practice since 1946, the three-day meeting was held concurrently with, although separate from, the annual convention of the Roadmasters' and Maintenance of Way Association, on September 15-17, at the Conrad Hilton Hotel, Chicago.

The two meetings were convened in joint session on Monday morning, September 15, and in another joint session on the afternoon of the following day. The program of the latter session included features of common interest to both groups, including an address by a railroad president and the presentation of a color motion picture showing the construction of the Quebec, North Shore & Labrador, a line 350 miles long located in northern Canada. The showing of this film was accompanied by remarks by Morris Bradley and Jack W. Buford. Both Mr. Buford and Mr. Bradley are connected with the M. A. Hanna Company, Cleveland, Ohio, one of the concerns sponsoring the construction of the new line. Another feature of the concurrent conventions was the annual banquet which was tendered to the members and their families of the two railroad associations by the Track Supply Association and the Bridge and Building Supply Association. In accordance with an agreement of several years' standing, no exhibit of manufacturers' products was sponsored by the two supply associations.

Attendance Was Good

In spite of the fact that only a week before the annual meetings of the two associations the City of Chicago had been host to the Centennial of Engineering, during which time many members of both the Bridge and Building Association and the Roadmasters' Association convened in the city for committee meetings of the American Railway Engineering Association, the combined attendance at the two meetings totaled 873 railway men, associate members, and guests. This figure included 580 railway men and 293 supply men (associate members) and guests. The total attendance figure for the previous year was 1,051.

The separate sessions of the Bridge and Building Association were directed by Guy E. Martin, president of the association, and superintendent of water service of the Illinois Central, Chicago, assisted by F. R. Spofford, first vice-president of the association, and assistant to the chief engineer of the Boston & Main, Boston.

Preliminary features of the joint opening session included greetings on behalf of the American Railway Engineering Association by its president, C. J. Geyer, vice-president, construction-maintenance of way, Chesapeake & Ohio, Huntington, W. Va.; the Track Supply Association by president R. W. Torbert, Oxweld Railroad Service Company; and the Bridge and Building Supply Association by president R. R. Clegg, American Lumber and Treating Company. Lewis Thomas, Q.&C. Company, secretary of the Track Supply Association, also spoke briefly at the joint opening session, inviting members of the two associations and their families to attend the annual banquet on Tuesday evening, which was sponsored by the two supply associations.

Supervisors Are "Backbone"

The roadmasters and the bridge and building supervisors are the "backbone and advance intelligence post of our railroads for the maintenance of the fixed property," declared Mr. Geyer. They must be relied upon to "foresee the need for maintenance—plan when and how the work should be done — get management approval for those plans — see that the work provided for in the program is properly carried out." Pointing out that he had been "in both positions" and that management approval seems to be the most difficult hurdle, Mr. Geyer said the "principal cause in my case was poor salesmanship on my part and the lack of patience and money on the part of my boss."

In Mr. Geyer's opinion "supervisory officers and top management are getting a clearer understanding of the problems of each other. There has never been any difference on the objective." He believes "we are entering a great change in the art of maintenance," the basis of which is "to plan and program for the maintenance of the fixed property according to the current needs brought about by the degradation from use and time." He is sure that such a method will result in a better maintained property at a lower cost in labor hours and units of material.

Principal speaker at the joint opening session was James H. Aydelott, vice-president, Operations and Maintenance department, Association of American Railroads. Immediately after the close of Mr. Aydelott's address, the two associations began their separate sessions.

President Martin Speaks

"Talk it up and build it up," comprised the theme of President Martin's address before the opening session of the meeting. In this, he was, of course, referring to the attitude which he would like to have the members assume toward their association. However, before getting into this aspect of his remarks he gave a resume of his stewardship of the affairs of the organization. He gave credit to the members of the Executive Committee for the "fine work" they had done and expressed his gratitude to the members of the subjects committees, "and particularly to the chairmen for the splendid reports they have developed this year."

Then, getting into the main theme of his remarks, Mr. Martin said that the purpose of any railroad association "is to assemble information on subjects or questions that have proved troublesome in the operation of railroads, and after having assembled such information, arrange to publish it in the form of annual proceedings for future reference, thereby providing a permanent record of the findings and conclusions. We gain knowledge principally by experience, either our own or that of someone else. I wonder if there is a man here today who can think back over his railroad experience and truthfully say that the reports as published in railroad association proceedings have not been very helpful to him in solving problems." When railroad men join together in an association to assemble information of their experiences and then arrange for preserving such information for posterity, they are only fulfilling an obligation, he declared.

Benefits Proportional to Work

Mr. Martin is convinced that the benefits from an association are directly proportional to the amount of interest and effort put into the work. "Certainly a subject committee's chairman will get more out of a question than will a committee member; likewise, a committee member will get more from a subject being studied than will another who does not volunteer for committee work. In addition to the satisfaction that comes from making a contribution to your chosen profession, and to mankind in general, there is financial reward for the man who prepares himself for greater responsibility, and association work will certainly improve anyone if entered into actively. The young man on a railroad cannot afford to pass up an opportunity to belong to an association organized for the advancement of the work in which he is interested."

Because of the benefits that accrue to railroads as a result of association work, Mr. Martin is convinced that "railroad management should encourage its employees to engage actively" in such work. One of the greatest responsibilities of a railroad officer, he said, "is to recommend men to fill supervisory positions, who will develop into good managers, capable of doing railroad maintenance and construction work in the best manner with minimum cost. Certainly, individuals who have indicated their desire to improve their position and increase their knowledge on a given subject are worthy of consideration for promotion. I do not believe that we are doing our full duty to the young men on our railroads unless we urge them to seek association membership; junior membership should be encouraged."

Much of the time of the separate sessions was devoted to the presentation and discussion of the eight technical committee reports, which dealt with the following subjects: Present Trends in Modernization of Passenger Stations; Restoring and Prolonging Life of Masonry Structures; Inspection and Maintenance of Water Tanks; Development in Power Tools and Machines; Safety Problems of the Supervisor; Fire Prevention Through Regular Inspections; Methods of Repair to Steel Bridges and Structures; and Maintenance of Track Scales. The report on Fire Prevention was followed by the showing of a motion picture depicting the results of tests of high-pressure foam as a fire-extinguishing agent in railroad service. The showing of the picture was accompanied by remarks by Frank Kluiber, sales engineer, John Bean Division, Food Machinery & Chemical Corporation.

Another feature of the program was an address on How to Make Durable Concrete, by George H. Paris, railway representative, Portland Cement Association. Demonstrations were used by Mr. Paris to emphasize a number of the points brought out in his address. Using actual materials, he demonstrated to his audience the effect of graduation of aggregates on the amount of past required, how workability can be varied by adjusting the quantity of aggregates added to the mix, keeping the water-cement ratio constant, and the effect of bulking of fine sand on the batching of materials.

On Wednesday afternoon, following the close of the regular sessions, a total of about 75 of those present at the two conventions attended a performance of the pageant, "Adam to Atom," at the Museum of Science and Industry in Chicago's Jackson Park. The pageant was created and produced as part of the Centennial of Engineering, consisting largely of a series of meetings of various engineering societies and associations and other activities at Chicago designed to celebrate the 100th anniversary of the founding of the American Society of Civil Engineers.

In the election of officers Mr. Spofford was advanced from first vice-president to president; Lee Mayfield, resident engineer, Missouri Pacific Lines, Houston, Tex., was advanced from second vice-president to first vice-president; H. M. Harlow, assistant general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, Va., was moved up from third vice-president to second vice-president; J. A. Jorlett, assistant engineer, Pennsylvania, New York, was advanced from fourth vice-president to third vice-president; R. R. Gunderson, assistant bridge engineer, Southern, Washington, D.C., was promoted from director to fourth vice-president; and L. C. Winkelhaus, architectural engineer, Chicago & North Western, Chicago, was re-elected treasurer. Directors elected were G. Switzer, assistant division engineer, Western Pacific, Sacramento, Cal.; J. F. Warrenfells, master carpenter, Seaboard Air Line, Savannah, (re-elected); and M. H. Dick, editor, Railway Track and Structures, Chicago (re-elected).

Two members were elected to honorary membership in the association. These men were Armstrong Chinn, president, Terminal Railroad Association of St. Louis, and E. C. Vandenburgh, retired chief engineer, Chicago & North Western, Chicago.

At the meeting of the Executive Committee of the association, which was held after the close of the convention on September 17, a list of seven subjects was chosen for presentation at the 1953 convention. These subjects are as follows: Modern Application of Machines and Power Tools to Bridge Maintenance; Selection and Training of Bridge and Building Department Personnel; Programming Repairs and Replacements; Rejuvenation of Safety Meetings; Ventilating and Air Conditioning of Railway Buildings; Conversion of Shop Buildings for Diesel Maintenance; and Furnishing Water Under Emergency Conditions.

REPORT OF NECROLOGY COMMITTEE TO THE PRESIDENT AND MEMBERS OF THE AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION:

Your committee appointed to report on the loss by death of members of this Association submits the following:

It is with much sorrow that we have learned of the loss of a total of 17 members not previously reported, including 5 active members, 10 life members, and 2 associate members.

From members, friends, and associates of deceased members information of their lives and activities has been obtained where possible. In some instances information of the passing of some members has been received too late to make inquiries. It is probable that other members have passed beyond of whom we have no information.

ACTIVE MEMBERS:

G. L. SITTON, Assistant to the Chief Engineer, Southern Railway System.

George Loyall Sitton died in Washington, D.C., April 2, 1952, survived by his wife, Mrs. Marie Danner Sitton and three children.

Mr. Sitton was born at Anniston, Ala., October 21, 1888. He graduated from the University of Tennessee in 1908. His entire career was spent with the Southern Railway System on which he was a laborer, transitman, assistant engineer, assistant roadmaster, resident engineer, engineer maintenance of way, and in 1924 was appointed chief engineer of maintenance of way, Eastern Lines, with headquarters at Charlotte, N.C. He held this position for 22 busy, happy and useful years. In 1946 he was appointed assistant chief engineer, system, at Washington, D.C., which position he relinquished in 1950 because of ailing health. He was then appointed assistant to the chief engineer. In 1951-52 he accepted temporary work with the National Production Authority.

Mr. Sitton joined the American Railway Bridge and Building Association in 1920 and since that time gave valuable assistance on many committees of which he was a member.

He was also active in the American Railway Engineering Association reaching the presidency March 14, 1950, from which position he resigned, unhappily, on April 25, 1950, because of the illness which led to his death. He was a member of the Roadmasters' and Maintenance of Way Association and served our sister organization in many capacities, becoming president 1939-40. Mr. Sitton was a devout Christian and a member of the Baptist Church. He accepted the misfortune that came his way with a cheerful Christian fortitude that was a revelation to those who witnessed it.

LIFE MEMBERS:

R. E. CAUDLE (Retired), Assistant Engineer of Structures, Missouri Pacific Lines.

Robert Emmett Caudle died at his home, July 10, 1952, at Houston, Tex. Burial was made at Chillicothe, Tex. He is survived by his wife, three sisters and a brother.

Mr. Caudle was born at Clarksburg, Tex., August 10, 1886. He has been active with the Missouri Pacific since August 1, 1915, and had previously worked — his first railroad job — as a trainman for the old Kansas City, Mexico & Orient, in that road's engineering department and in the engineering department of the Texas & Pacific. His service with the Missouri Pacific included instrumentman, division engineer, supervisor of bridges and buildings, assistant engineer of structures, office engineer, principal assistant engineer and lastly, assistant engineer of structures at Houston, from which position he retired on January 1, 1952.

In addition to his work in the railroad's engineering department, Mr. Caudle was a definitive historian of the Texas scene, especially as it involves railroads. He wrote "West of the Sabine," some years ago and many authorities have declared the work to be one of the outstanding reference books of the development of railroad transportation in Texas. In addition, he produced an exhaustive and comprehensive history of the development of the various components of the Missouri Pacific in Texas and in southern Louisiana.

Mr. Caudle joined the Association in 1921, became a director in 1940, and served as first vice-president during the critical war years between 1942 and 1945. He served his association well. He was elected to life membership early in 1952.

T. L. D. HADWEN (Retired), Engineer, Masonry Construction, Chicago, Milwaukee, St. Paul & Pacific.

Theodore Lovel Donner Hadwen died at his home in Chicago on June 5, 1952. He is survived by his wife, Mrs. Ivah Kirkwood Hadwen.

Mr. Hadwen was born May 26, 1872 at Richmond, Surrey, England. He received his engineering education from what was then known as City and Guilds of London Institute, now called the Imperial College of Science and Technology, and was graduated in 1893. In the fall of that year he came to the United States, becoming a naturalized citizen on April 7, 1903. He resided for 30 years in Oak Park, Ill., and spent the rest of his life in Elgin, Ill., Marion, Iowa, and Chicago.

His entire railroad career was spent with the Milwaukee Road, from which he retired in 1937. Mr. Hadwen was a renowned traveler, his taste for travel having been acquired from trips abroad in his early life with his mother, and a long voyage with his uncle, a captain in the English Merchant Service. He was an inveterate walker and did considerable mountain climbing in Switzerland. Until he reached the age of 66, he would take a yearly walk around Lake Geneva, Wis., a distance of 26 miles, in about 8 hours. Mr. Hadwen joined the American Railway Bridge and Building Association in 1907, and was, at the time of his death, the Association's fourth oldest member. He became a director in 1908 and served through various chairs, becoming president in 1914. His contemporaries were C. A. Lichty, G. W. Rear, J. P. Canty, C. E. Smith, and C. R. Knowles. Last year at the celebration of the 60th anniversary of the Association, Mr. Hadwen was honored as the oldest living past president in attendance at the celebration.

Mr. Hadwen was a life member of the Western Society of Engineers, a life member of the American Society of Civil Engineers, and a member of the Illinois Section.

Mr. Hadwen was also a writer and since his retirement wrote for his wife an autobiography covering all his colorful early life, his Victorian reminiscences, and contacts with many interesting people.

J. S. HUNTOON (Retired), Assistant Bridge Engineer, Michigan Central (N.Y.C.)

John S. Huntoon died at his home, 250 Grove Avenue, Highland Park, Mich., June 16, 1952. He is survived by his wife, Mrs. Delia L. Huntoon, and sons Frederick, Plant Manager of the Moline Manufacturing Company, and Richard, associated with the Detroit Transmission Company, division of the General Motors, and more recently recalled to service by the U.S. Navy.

Mr. Huntoon was born at Moline, Ill., May 15, 1879, graduated from the University of Illinois with a degree in Civil Engineering, and entered the service of the Michigan Central, February 26, 1906, as a draftsman at Detroit, Mich. He served as chief bridge inspector until November 1, 1919, when he was appointed assistant bridge engineer—the position he held at the time of his retirement in 1948. He was a pioneer in the design of reinforced concrete cribbing. For the last ten years he was retained as engineering consultant for the Detroit, Caro & Sandusky Railroad at Caro, Mich. Mr. Huntoon joined the Association in 1915, became a director in 1923, and served successively through the various offices, becoming president in 1929. Like Mr. Hadwen he was also associated with some of the Association stalwarts, Cal Lichty, Elmer Howson, Maro Johnson, and Tom Strate.

G. G. McCUE (Retired), Bridge and Building Master, Grand Trunk Railways, Canadian National Railway.

Mr. G. G. McCue, who joined the Association in 1913, and who was a life member, died in 1952. His last address of record was 369 Main Street, East Ottawa, Canada, (Ontario). We shall try to obtain additional information for publication in the proceedings.

ACCOCIATE MEMBERS:

C. C. RAUSCH, Vice-President, Dearborn Chemical Company.

Clarence Charles Rausch, a resident of Chicago died in his sleep at Galveston, Texas,

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SECRETARY'S REPORT
of
MEMBERSHIP AS OF SEPTEMBER 17, 1952

Active Members as of September 1, 1951		472	
New Active Members since September 1, 1951		42	514
Less—Reported deceased	5		
Resigned account retirement, etc.	6		
Transferred to Life Membership	3		
Dropped account did not pay dues	45		59
Total Active Members, September 1, 1952			455
Associate Members as of September 1, 1951		115	
New Associate Members since September 1, 1951		1	
		116	
Less—Reported deceased	2		
Resigned	4		
Dropped account did not pay dues	9	15	
Total Associate Members, September 1, 1952			101
Life Members as of September 1, 1951		85	
Transferred from Active Membership (Elected to Life Membership during the year)		3	
		88	
Less—Reported deceased	8		
Dropped account mail returned	8	16	
		72	
Total Life Members, September 1, 1952			72
Honorary Members as of September 1, 1952			5
Total Membership, September 1, 1952			633

on April 29, 1952. He was buried at Fairmont Cemetery, Willow Springs, Ill. He was unmarried.

Mr. Rausch was born August 21, 1894, in Chicago, and attended the College of Commerce, Northwestern University, graduating in 1924. He began his business career with his father's contracting company and later worked for four years in the operating department of the Pennsylvania.

Joining Dearborn Chemical on June 20, 1920, he served in the accounting department, in charge of motor oil sales, and then in the sales department. For many years he devoted his efforts to the promotion of NO-OX-ID rust preventives in the railroad industry. In 1941 he was made assistant vice-president, and in 1950 was named manager of the NO-OX-ID sales division. Mr. Rausch joined the Association in 1944. He was a member of the Allied Railway Supply Association, serving one year as president, the American Gas Association, and the American Petroleum Institute.

His brother, George A., of Washington, D.C., an uncle, George C. Miller, and an aunt, Mrs. Carrie Hoeft, survive him.

It is with a feeling of sadness and a sense of great loss that we note the passing of these fellow members and associate. Their memory will remain long with us. We mourn the loss of these our brethren and express our sorrow to their loved ones.

J. A. JORLETT, *Chairman*
R. R. GUNDERSON
M. H. DICK
Necrology Committee

RESOLUTIONS COMMITTEE

The American Railway Bridge and Building Association in convention assembled, recognizing that the special efforts of certain parties should be fittingly acknowledged, does hereby recommend the following resolutions, to wit:

Be it resolved that the appreciation of the officers, members and guests of this Association be expressed to the management and personnel of the Conrad Hilton Hotel for the co-operation and hospitality we have enjoyed.

Be it further resolved that the sincere thanks of the officers and members of this Association be extended to the Simmons

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TREASURER'S REPORT

SEPTEMBER 1, 1951 TO AUGUST 31, 1952

Cash Balance—September 1, 1951		$2,581.76
RECEIPTS:		
Dues	$2,669.00	
Advertising (1950 Proceedings)	2,319.50	
Miscellaneous	12.91	5,001.41
Total		$7,583.17
DISBURSEMENTS:		
Salaries	$1,028.84	
Social Security and Withholding Taxes	203.28	
Stationery and Printing (Including 1951 Proceedings)	2,452.92	
Office Supplies	43.66	
Postage	270.63	
Rent, Telephone, Electricity	304.67	
Convention Expense for 1951	311.95	
Miscellaneous	50.14	4,666.09
Cash on hand, August 31, 1952		$2,917.08
ACCOUNTS RECEIVABLE:		
Due from Advertisers in 1951 Proceedings as of August 31, 1952		2,440.00
Total as of August 31, 1952		$5,357.08

L. C. WINKELHAUS,
Treasurer

APPROVED:
T. H. STRATE,
Chairman, Auditing Committee
September 5, 1952

Boardman Publishing Corporation and its representatives. Their assistance and interest has been invaluable.

Be it further resolved that the sincere appreciation and thanks of the officers, members and guests of this Association be extended to the officers and members of the Bridge and Building Supply Men's Association and to the Track Supply Association. Their untiring and devoted support of our Association at the convention and throughout the year is a vital factor in the success of our efforts. The banquet and entertainment is a bright spot in the year.

Be it further resolved that the sincere appreciation and thanks of this Association be extended to Mr. J. H. Aydelott, Vice President, Association of American Railroads: to Mr. Wayne A. Johnston, President, Illinois Central Railroad; to Mr. Armstrong Chinn, President, St. Louis Terminal Railroad: to Mr. J. W. Buford and Mr. Morris Bradley of the M. A. Hanna Company.

Be it further resolved that the appreciation and thanks of the officers, members and guests of this Association be extended to Mr. George H. Paris and his Assistant, Claude Burris, and to the Portland Cement Association for their efforts in our behalf.

Be it further resolved that the appreciation of the officers and members of this Association be extended to Mr. J. T. Hawkinson and the Illinois Central Railroad for their efforts in our behalf.

Your Resolutions Committee recommends that these resolves be spread upon the Minutes of the convention so that it becomes a part of our Annual Proceedings and that copies of these resolves be forwarded to the parties concerned.

F. R. Spofford, *Chairman*
R. E. Dove,
R. R. Gunderson,
Resolutions Committee

REPORT OF AUDITING COMMITTEE

TO THE PRESIDENT AND MEMBERS OF THE AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION:

We, the undersigned members of the Auditing Committee, have examined the books of the Secretary for the period September 1, 1951 to August 31, 1952, inclusive, and have found them to be correct as of the latter date.

Respectfully submitted,
T. H. Strate, *Chairman*
A. E. Bechtelheimer
B. R. Meyers, *Auditing Committee*

Abstracts of the addresses by Messrs. Aydelotte and Johnston, as delivered before the joint sessions, are presented below.

Importance of Economies

Principal speaker at the joint opening session was James H. Aydelott, vice-president, Operations and Maintenance department, Association of American Railroads. "It can properly be said," declared Mr. Aydelott "that in these days of pyramiding costs of everything connected with the operation and maintenance of a railroad, with competition from other forms of transportation at its highest level, and with rate increases stubbornly resisted, the question of whether a railroad can operate successfully and with a profit may depend on how much it can save rather than how much it can gross from its services." He then explained how it sometimes happens that railroads find it necessary to use available money to acquire equipment and to improve yard and station facilities with which to handle the traffic — "money which otherwise could have been available for the programs in which you men are vitally interested and which you believe would bring sizable, though in some cases, long-range economies in your own departments."

Even in the days before modern equipment and heavier rail came into wide use "it was considered," said Mr. Aydelott, "that if the combined maintenance items, Roadway and Equipment, could be held to an expenditure of 32 cents out of each dollar of earnings a railroad would be assured of a successful and profitable operation." Based on the operating revenues of the railroads in 1951, a reduction from 33.6 cents to 32 cents for all maintenance expense, or 1.6 cents, would have added about 165 million dollars to the net railway operating income of the Class I railroads."

Mr. Aydelott said the steel strike retarded all of the programs of the railroads in which steel is used, and "it is not unlikely that tonnage in new rail will fall short in 1952 by perhaps 400,000 tons of meeting the programmed requirements of the railroads." The railroads will, therefore, be faced with the necessity of carrying over into 1953 uncompleted rail and bridge programs which "you had hoped could be completed this year as a necessary step in meeting defense mobilization goals." "It is an unhealthy condition, "he concluded, "but there appears to be nothing we can do about it except to keep the situation before the governmental agencies which are making the distribution of steel as it is produced by the mills."

Importance of Good Supervision

At the joint session on Tuesday afternoon the principal speaker was Wayne Johnston, president of the Illinois Central, whose subject was "The Men Who Run Our Railroads." Because the problem of supervision is such a big one, Mr. Johnston said he would be able to "hit only some of the highlights." But, he added, "it won't be what I have to say here today that will make any of us better supervisors. That is something that will have to come from within ourselves. But I do hope to be able to stimulate our interests in reading and thinking and studying further in this important field." Declaring that the quality of its supervision is one of the keys to the success of any organization, Mr. Johnston said that he was not talking about top supervision alone, but about supervision down the line, "right down to the level of the section foreman and his equivalent in other departments. It is this kind of supervision that is the backbone of a company's personnel structure."

Mr. Johnston suggested that his audience would find useful "this simple method of thinking about supervision: The good supervisor looks upstairs, he looks downstairs and he looks out over the same floor, or the same level."

"He looks upstairs," continued the speaker, "to be informed about things for which he is responsible. He needs to be informed about company policy, so that he can interpret that policy in the right spirit as well as to the letter. As all of you can appreciate, the interpretation of a policy is often as important as the policy itself."

Mr. Johnston said that the "good supervisor is also looking upstairs when he seeks opportunities to develop the ability of his subordinates. This is something he has to do if he is to be ready and available for a better job. Think back in your experience. If there is no one capable of taking your place you stand a small chance of being called to move up." Mr. Johnston realizes that what he was suggesting "goes against one of the basic instincts of human nature. All of us naturally like to feel that we have knowledge that makes us a little more valuable than the next fellow and which we are reluctant to impart to someone else, but unless we overcome this selfish feeling we hurt ourselves eventually."

"The good supervisor naturally keeps a good weather eye open on what is happening downstairs," said Mr. Johnston. "He keeps his people informed as to what is going on in the business in which he and they are making their living." However, "it is no simple task for a busy supervisor concerned with getting the job done to take the time to explain the why and wherefore of company policy. There is a tendency among some supervisors to stand aloof from the company policy, as though they have nothing to do with it. If disciplinary action is involved, they shift the blame over to company policy and the 'brass hats' upstairs. Obviously, this kind of supervisor is a supervisor in name only. He isn't doing the job he was hired to do."

Mr. Johnston went on to enumerate a number of rules or principles for the guidance of supervisors. One of the oldest of these, he said, is to get all the facts before disciplining an employee. Another is that the "wise boss does not discipline a man in the presence of others. The hurt pride and the humiliation felt by the man being disciplined can only build up resentment and cause trouble in the future." Finally, he said, the good supervisor always seeks to "build himself up with his employees. He seeks to make them trust and respect him. He always tries to remember to be fair even to those he may dislike."

A word of caution was offered by Mr. Johnston regarding the use of rules for being a good supervisor. The trouble is, he said, that even though the supervisor knows these rules, he has to apply them in situations which probably almost never are like the ones described in the lessons. As a consequence, he went on, it is necessary to rely on experience in many instances, but here again a difficulty is imposed because "apparently all of us don't learn the same things from experience." For instance, he said, "some of us 'have learned' (and I put the word in quotes) that women drivers are always poorer than men." On the other hand, he continued, "other people have 'learned' from their experience that women drivers are more careful than men and have less accidents.". What this means is that "it is a difficult achievement to be able to draw valid and useful lessons from our experience. None of us has an entirely adequate background in every field; hence we often work from inadequate generalizations, beliefs and attitudes.

"That means that all of us are faced with the need for 'unlearning' a lot of things we are sure about. As someone aptly has said, it is not people's ignorance, but 'what they knows that ain't so,' that gets them into trouble. We don't want supervisors who know all the answers, who are positive about what the 'proper' attitude of people should be and who work from a straight set of rules that they apply without thinking."

Fire Prevention Through Regular Inspections

Report of Committee

COMMITTEE—H. B. LORENCE, *Chairman*, fire protection engr., C.R.& I., Hammond, Ind.; W. H. PRYOR, *Vice-Chairman*, gen. foreman b. & b., St.L.-S.F., Memphis, Tenn.; G. F. PRUDE, *Vice-Chairman*, asst. b. & b. supv., T.& N.O., Houston, Tex.; J. N. BURKEL, draftsman, M.P., St. Louis, Mo.; I. L. GLASSGOLD, president, B.& O. Coal Pier, Baltimore, Md.; H. M. HARLOW, asst. gen. supv. b.& b., C.& O., Richmond, Va.; F. W. HUTCHESON, supv. b.& b., C.& O., Newport News, Va.; P. L. KOEHLER, asst. supt., C.& O., Peach Creek, W. Va.; F. O. MCGREW, ch. carp., C.M.St.P.& P., Terre Haute, Ind.; L. R. MORGAN, fire protection engr., N.Y.C., Detroit, Mich.; C. U. SMITH, consult. engr., Lindsay, Cal.; B. M. WHITEHOUSE, ch. fire insp., C.& N.W., Chicago, Ill.; L. L. SMITH, asst. b.& b. supv., S.P., Dunsmuir, Cal.; V. W. HUTCHINGS, b.& b. supv., S.P., Bakersfield, Cal.

Effective fire prevention is the responsibility of all supervisory personnel, and it is only through their fullest cooperation that a worthwhile program for fire prevention can be effected.

Good Housekeeping

Good housekeeping is fundamental to good fire prevention practice and it should be the duty of the supervisors of forces occupying buildings to maintain a high standard of housekeeping, both within the building and in the surrounding area.

Carelessly discarded smoking material may easily ignite waste paper and miscellaneous trash unless these items are kept from accumulating on the floor. It should be clearly understood and enforced that all discarded smoking material must be placed in an appropriate container provided for that purpose and decisive action should be taken when inspections disclose violations of this rule. The proper use of metal waste baskets and covered metal containers for waste paper should likewise be enforced.

Maintenance of buildings and bridges should not be neglected as fires frequently are caused by sparks lodging in decayed wood members.

Careful inspection of heating and cooking devices should be made by bridge and building foremen and supervisors to insure that the installations are in accordance with requirements as set forth by the code having jurisdiction, that is, state, province, city or town ordinances which govern the territory involved. In the absence of such regulations, the installations should be in accordance with the recommendations of the National Board of Fire Underwriters. Careful attention should be given to clearances from such devices in order to avoid ignition of adjacent inflammable walls and floors, and where recommended clearances are not feasible, and suitable protective shielding, with air spaces behind them, should be provided.

The ever-increasing use of oil as a fuel has resulted in the installation of many oil-fired units and the consequent installation of fuel-oil storage tanks for supply. The regulations pertaining to the installation of such tanks are clear and should be carefully followed with special attention to adequate venting, proper distance from burner, automatic oil supply cut-off, and manual shut-off valves, both at tanks and at the burner. Similar attention should be given to the smoke pipe and chimney since requirements for these items are identical for both oil-fired and coal-fired units. Proper first-aid fire protection should be provided; dry chemical, carbon dioxide, foam and carbon-tetrachloride types being recommended with preference being in the order given. The extinguisher should be placed near the exit door and maintained in accordance with instructions shown on it.

Extinguishers for use at other locations include soda-acid, foam, dry-chemical, carbon-dioxide, carbon-tetrachloride, and pump-tank types, and fire barrels with pails. These should all be given surface inspections at least monthly and charged annually in accordance with instructions, which are usually shown on the extinguishers. The carbon-tetrachloride and the pump-tank types, once properly charged, need no recharging until used, but the pump operation must be checked monthly to insure against corrosion forming on the pump rod. The soda-acid and foam types must be protected against freezing, and the water in pump-tank types and in fire barrels should be treated with calcium chloride to prevent freezing. The content of this solution should be checked annually with an appropriate hydrometer. Fire barrels are often subject to damage, and may also be tipped over by trespassers. However, in circumstances where other fire protection is not feasible, it is necessary to use the fire barrels and provide necessary inspection to assure proper maintenance. Metal drums are most commonly used, but consideration should also be given to the possible use of concrete or wood drums to avoid the corrosion experienced with the metal type.

Water Supply

Fire hydrants on fire lines should be located with careful consideration of properties to be protected. Frequently hydrants are located in positions where they would be rendered inaccessible due to their close proximity to structures which they are intended to protect.

If it is intended to use water for fire protection at diesel fueling and repair facilities, sufficient water pressure must be provided to combat oil fires with fog spray. Hydrants should be inspected and flushed at least twice yearly and fire hose should be given a hydrostatic test annually (with the exception of linen hose).

Good housekeeping is of first importance around diesel facilities and this can only be obtained by limiting diesel oil spillage at fueling stations to an absolute minimum. Inspectors should carefully check typical performance of attendants and caution them as indicated. Care should be taken to provide closed metal containers for oily rags, and these and other rubbish should be removed daily. At some diesel storage tanks, permanent built-in foam fire protection is provided and, where such is the case, the system should be tested semi-annually. Where freezing weather is encountered it is preferable to schedule the testing so as to avoid possibility of freezing the water in the pipes.

Cooperative Inspections

In the larger towns and cities it is the prerogative of the fire prevention bureau, inspection department, or fire marshal to make periodical inspections of railroad properties. Results of inspections are generally reported to the proper authorities for correction or possible improvement of conditions existing. It is considered good practice to keep municipal fire-fighting forces familiarized with the location of hydrants and other fire equipment that would be required speedily in the event of fire.

Railroads having purchased insurance are inspected at various intervals by qualified insurance inspectors whose duty it is to ferret out sub-standard and hazardous conditions; make suggestions for additions to, or improvement of, fire protection facilities, and finally report on conditions found to the insurance group represented. Report is then formally submitted to the railroad management for handling.

As watchmen of the railroad, it is the duty of special agents or property-protection personnel to report any unusual conditions existing that could result in a fire being caused. In the duty of special agents or property-protection personnel fire extinguishers should be checked to see that they are located properly and in operating condition. Fires of a suspicious nature are investigated by the special agent to determine if trespassers or possible saboteurs are responsible.

This report is intended for the use of bridge and building supervisors; consequently it does not include any reference to inspection activities of employee occupants of buildings, but rather refers to conditions for which the supervisor is responsible or in a position to make necessary corrections.

In addition to the items heretofore discussed, there are phases of maintenance and construction work which, unless supervised, may be involved in fires. The paint gangs should be very careful in the disposition of paint rags; otherwise spontaneous ignition may occur in such rags. Likewise smoking should be prohibited in areas where painting is in progress. The ground under wood trestles and bridges should be kept free of weeds and grass, either by successive scuffing or soil sterilization by chemicals. Newly creosoted bridge ties will bleed the creosote; therefore it is advisable to apply sand so as to make ignition less likely to occur. After the bridge deck has weathered to the point where the bleeding of creosote has ceased, consideration may be given to the use of protective coatings involving an asphalt base, which have been designed so as to minimize fire risks.

In conclusion, the committee again wishes to stress the importance of good housekeeping and strict enforcement of "no smoking" rules in designated areas where the fire risk is high. Many fires may be prevented through regular inspection by bridge and building foremen and supervisors, provided corrective action is taken where it is indicated.

Discussion

E. B. Tourtellotte (B&M) stated that considerable oil was spilled on the track around diesel fueling stations and asked what the general practice was for reducing the hazard of fires at such points. Chairman Lorence said that if the spillage neared the saturation point, the fouled ballast should be changed out.

W. A. Huckstep (MP) said that, since there are three principal types of fire-extinguishing agents, it was important that the correct type be used. He added that his road has painted bands of distinctive colors (one for fires of electrical origin, another for merchandise, and the third for oils) on the three types of extinguishers furnished, and that placards describing the use of each have been mounted on premises so that the correct type will be grabbed in an emergency.

When C. S. Crites (B&O, ret.) said that too much reliance should not be placed on fire barrels and pails in this era of dieselization and that sand would be more suitable, L. R. Morgan (NYC) replied that, although sand was undoubtedly better for quenching diesel oil fires than water, which acts as a spreading agent, he was convinced that water barrels should not be eliminated, as a canvass of his road had revealed that they had been used 11 times in the past year for putting out fires and had saved thousands of dollars in damage.

M. Norris (D&H) said it has been his experience that carbon tetrachloride causes a chemical action on the metal at the tops of such extinguishers which often renders them useless.

Methods of Repairs to Steel Bridges and Structures

Report of Committee

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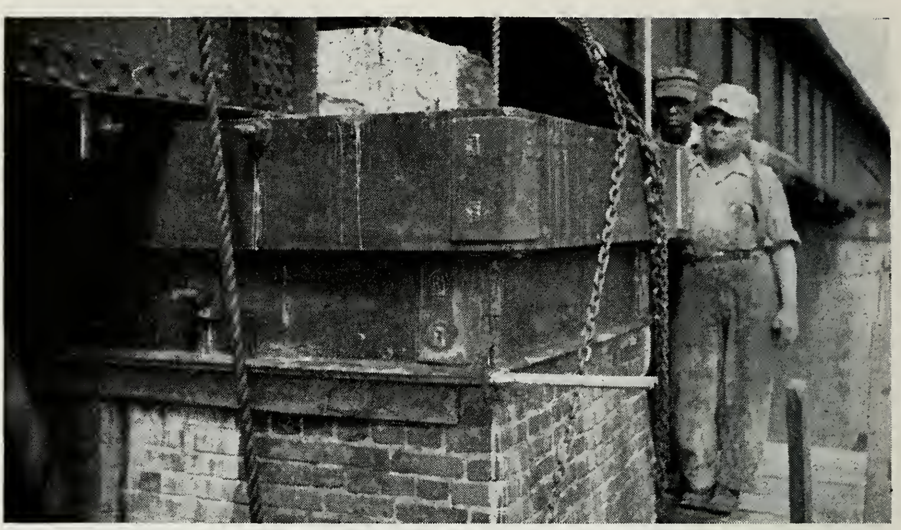
Steel bridges are a vital link in the rail transportation system. Their maintenance in condition for safe operation at schedule speeds often requires repairs of various degrees. Each bridge repair problem must be considered on its own merits, for what may be an economical solution to a problem on one bridge or on one railroad may be entirely uneconomical on another bridge or railroad. With this in mind, we will briefly discuss some conditions leading to bridge repairs, a few methods of solving repair problems, the



To repair the deteriorated pedestal stone atop a brick pier, the welded channel assembly shown above was used. Voids were filled with grout.

advantages and disadvantages of each method, and outline the factors that should be considered in selecting the method for making repairs. We must stress the fact that the repair of each structure is an individual problem and must be considered on its own merits and that few fast and hard rules can be made for this type of work. On heavy-duty main lines, with present high speeds and tight schedules, it is often imperative to select a method of repair that will result in a minimum interruption to traffic.

Space will not permit a discussion of field inspection or practices of scheduling necessary repairs.

Conditions Requiring Repairs

The need for repairs to steel structures is often brought about by overloading and overstressing which result ordinarily from changing operating or usage conditions. These terms are slightly misleading because what one man may consider overloaded or overstressed may not be so regarded by another man. Our knowledge of the strength of materials is our yardstick and no competent engineer is going to tolerate unsafe conditions. Few steel structures can be subjected to loading much beyond their intended usage without developing conditions that require repairs. Few steel structures fail without some advance warning, and close observation and inspection will usually detect weaknesses in sufficient time to allow proper repairs to be made. Cracks in some members, mechanical wear of pin connections, loosening of rivets, excessive deflection, and other readily apparent conditions usually forewarn us of needed repair work.

Several railroads have made actual stress measurements on bridges where a question existed as to what load was allowable. These tests have been of great value to everyone interested in these problems. This information is available to all interested parties through publications of the American Railway Engineering Association. The tests and experiments are continuing. We will not attempt to discuss this technical field.

Corrosion

Corrosion and deterioration comprise another cause for repairs. Good housekeeping, as applied to bridge maintenance, will accomplish much in preventing these forms of damage to steel bridges. An accumulation of dirt, cinders, dust, etc., permitted to lie on flat surfaces of steel will collect and hold moisture to the extent that paint protection is destroyed and resulting damage to steel is greatly accelerated.

It is much better economy to prevent damage than it is to develop a good method of making repairs after damage has occurred. Reference is made to the report "Protecting Steel Structures from Severe Corrosion,"

In this operation, top angles were renewed without removing deck using only light equipment. Two angles were renewed in less than two hours.

which was published in the 1940 Proceedings of the association. This investigation did not find the cure for the destruction of steel by brine, smoke, blast and diesel exhaust gases. This is still one of our major problems.

Corrosion is caused by chemical and electrolytic action on the steel and in many cases is difficult to detect before considerable damage has resulted. Generally, corrosion requires air and moisture before the action takes place. This can occur beneath an apparently good film of paint and has also been reported beneath a complete concrete encasement. Dirt and debris in contact with steel members provide ideal conditions for allowing corrosion to set in.

Corrosion becomes apparent when paint begins to blister or scale and should be suspected when cracks or open joints exist in any encasing material. Early detection is very desirable because of the progressive action of corrosion, and serious damage can result if no repairs are made. Any structure exposed to the action of brine drippings, smoke or fumes, is especially susceptible to corrosion, and careful inspections should be made regularly.

Blast from steam locomotives can cause serious deterioration of members unless special methods of protection are provided. This condition is easily detected by inspection, and repairs can be made before the damage becomes excessive.

Extensive investigation is being made of the problems of corrosion but no cure-all answer can be reported.

Structures are often damaged as a result of accidents. Such damage is caused in very unpredictable ways, but there is rarely any question about the need for repairs. The problem is usually governed by the nature of the accident. The extent of damage may require placing only a slow order, or the line of road may be completely blocked and traffic detoured. Speedy repair is usually necessary and many temporary expedients are employed before final repairs are completed.

Through-truss bridges are vulnerable to accidents resulting from derailments or shifted loads. End posts, vertical and diagonal members, and bracing can be damaged in varying degrees. The floor system is rarely totally damaged and the structure can often be put back in service by installing falsework. End posts and other truss members can be partially or completely straightened and reinforced by installing timber struts and other materials to relieve the damaged members. Welding reinforcing plates and members can be done rapidly and is often effective.

Stiffeners of plate girder spans are often bent during accidents. Temporary repairs can be made by installing timber struts and bolting them in place. Generally the stiffeners can be sufficiently straightened to allow temporary operation or reinforcing plates can be welded alongside the damaged members. Special precautions must be taken when the principal flange members of girders are damaged in an accident. It may be necessary to relieve the span by temporarily installing falsework.

Many railroad structures over streets or highways are liable to damage from loads being transported on the highways. It is not uncommon for such structures to be moved on their supports, causing serious danger to high-speed rail traffic by shifting the track alinement. Track can usually be shifted on the bridge deck to allow temporary slow speed train operation, but repairs to the structure are generally necessary. It is very common in such accidents to find that the lower flanges of the structure are bent or nicked. Accidents also occur on structures carrying highways over railroad tracks. Most of these accidents are brought about by excessively heavy loads or by vehicles crashing through the protective railings. Some measure of protection is obtained by conspicuously posting clearance signs and allowable load limits, but this does not entirely prevent accidents.

Fatigue, Defective Design

Railway maintenance men generally are not familiar with failures in bridges caused by fatigue or defects in design and construction. Likewise we do not refer to some troublesome features in structures as stress raisers. However, if these features exist in a structure they will eventually cause trouble and require repairs. We mention these features as causes for repairs but do not propose to discuss these rather technical problems in this report.

Several committees of the AREA are investigating these problems and considerable research work is being done to offer some help and guidance to designing engineers. Our understanding of these factors is constantly broadening and our methods of repairs are continually improving.

Types of Repairs

The special problem of repairing any particular bridge will generally establish the type or method of repair to be made. The problem is further complicated by present conditions where labor costs are high and materials are not always readily available. Some practices and methods can be recited and some solutions presented.

Many railroads prefer to replace structural members complete without attempting repairs to the member. The cost element can be more accurately estimated and the success of the repair job may be more assured. It is often difficult to forecast repair costs when complicated repairs are indicated. It is often quicker and cheaper to replace flange angles, stringers, floorbeams, turntable truck frames, and other selected members than to attempt repairs of the members in place.

Splicing in a portion of a member can be done economically under some conditions, particularly in bracing and on bottoms of stiffener angles where plates can be welded to outstanding legs of angles. This method is most useful when the need for repair is confined to part of a member.

Reinforcing Members

There is a wide range of work done by the various roads in reinforcing members by adding cover plates, either riveted of welded, additional flange angles below top flange angles and above bottom flange angles, additional cross frames, and stiffener angles. In addition to angles below the top flange angles one road reports that they trimmed off the outstanding legs of old angles and placed a riveted section of two angles and a cover plate set down over the web and the vertical legs of the top angles. This can sometimes be used when outstanding legs of top angles are nearly destroyed and there is not a good bearing for the ties.

Another road reports that it has reinforced stringers by welding plates on the top and bottom of the stringers. The bottom plate is slightly wider than the bottom flange and the top plate slightly narrower than the top flange but thicker than the bottom plate in order to produce the same section. In this manner all of the welding is down hand. It has been found that a continuous weld is better because bleeding occurs at a stitch weld. The top plate is full length to avoid change in tie dap and the bottom plate long enough to develop required strength.

Another road reports placing plates on the tops of I-beam stringers where the top flanges were badly damaged from brine. The plates were 2 in. wider than the old flanges to provide improved tie bearing. These were stud welded, the welds being made in the spaces between ties and staggered. The welds were made in 1-in. by 2-in. elliptical holes in a ⅝-in. by 8-in. plate. Still another road reports reinforcing the end bearings of a double intersection deck truss to equalize the stresses in the members intersecting at the end bearings. This same road has reinforced counterweight supporting members on a three-track bascule bridge, and results are satisfactory.

The shortening of eye-bars is an expedient that is frequently required in connection with bridge repairs. One method that is used involves the controlled heating and upsetting of the member to produce the necessary shortening. Another is to cut the bar, weld a bar on each side and fill in the gap by welding after proper tension has been secured. A third is to cut out a piece of the bar and weld in turnbuckles.

Types of Fastenings

Again we must stress that each repair job is an individual problem. There is considerable engineering knowledge and many reports on the advantages of riveting, welding, and the use of bolts, including recent tests of high-strength bolts on the Chicago & North Western. The method should be used which is both suitable and available.

The smaller roads attempt to schedule ordinary steel repairs so that they can be done in connection with painting. There is usually some work which requires an air compressor and a few rivets can be driven at the same time. These roads often depend on contract welders and the cost of moving a welding outfit in for a small repair job cannot be justified. A top or bottom cover plate, originally riveted, can generally be most economically replaced by riveting.

Reference is made to an article in the June, 1952 issue of Civil Engineering magazine, entitled "Are We Ready for All-Welded Railroad Bridges." This article is most interesting and should be read by anyone considering making repairs by fusion welding. A riveted joint will indicate that it is overstressed, and can be repaired before failure. Apparently a weld gives little indication of overstress before actual failure.

Repairs by Welding

Repairs and strengthening of steel bridges by welding have often been a lifesaver to the railroads. However, no welding should be done until the man or men responsible for the work have had sufficient experience and training to insure that the welding is done properly.

One state highway department, when welding a steel-plate floor on a new truss bridge, found that, after the floor was welded on, the eye-bars in several of the lower chord members were severely buckled, showing that the plate floor had contracted enough to take the dead load off the lower chord members. Welding heavy steel bearing plates to the ends of I-beam spans, can cause the bearing plate to take the shape of a chair rocker due to the shrinkage of the steel at the two lines of weld made across the top of the plates. Similar troubles can occur if the work is not performed in accordance with best known methods and by well-experienced welders.

One report covers the restoration of several thousand rivet heads by arc-welding a $\frac{3}{8}$-in. circular fillet weld around the rivet shank, fusing this to the girder web and making a job that has held as well as the original rivets. This method is particularly adaptable to repairs where only one side of the rivets can be reached. One road reports welding cracked bottom angles of a deck plate girder by the oxyacetylene process, and that it is holding well.

When making bolted connections several roads recommend a high-strength drive bolt of correct length in an accurately reamed hole which is $\frac{1}{16}$-in. smaller in diameter than the bolt shank, to be used only in non-critical connections. Special high-tension bolts applied with the aid of calibrated torque wrenches, can often be used instead of rivets when repairing or replacing certain connections.

Each steel bridge or structural repair job must be considered on its own merits. The method of repair will depend on the conditions which demand repairs, the urgency of the work, the men and equipment available, the type of fastening best fitted for the work, and in all cases should be in accordance with a plan which is agreed on by all concerned before the work is undertaken.

Discussion

R. R. Gunderson (SOU) began the discussion by asking how high-strength bolts are used when making repairs, and L. D. Garis (C&NW) stated that a test of the use of these bolts for replacing loosened bolts at the bottoms of crossframes is under way on the AREA. This was amplified by A. A. Sirel (AREA) who announced that more than 1,000 high-strength bolts were installed two or three years ago, which have been given 6-mo. and 1-yr. inspections since then. These were found to be in good condition. The high-strength bolts have a yield point of about 75,000 psi., he said, as compared with 30,000 psi. for rivets. High-strength bolts are used for their clamping action and should be applied with a torque wrench for obtaining the calibrated clamping results. They do not have to fit the holes exactly. Rib bolts, he said, are driven, hence have some reduction in their section.

Mr. Garis pointed out that, where two roads operate over a structure, it is important for the inspectors to understand positively whose responsibility it is for making detailed close inspections. He cited an instance where the bridge inspector of the railroad maintaining a bridge over a city street thought that the inspector of the other road was making the close inspection. On the other hand, the inspector of the second road believed that the first inspector was making this close inspection. The fact that the bridge was receiving only cursory inspections was not known by either until extensive repairs became necessary.

Present Trends in the Modernization of Passenger Stations

Report of Committee

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During the last 15 years the railroads have made great strides in the improvement of passenger-train equipment and speeds to meet the ever-increasing competition from private automobiles and air and bus travel. Along with the advent of the streamlined train, it also became apparent that many of the railroads' passenger stations were antiquated and in need of modernization to bring them up to present requirements.

Several railroads have started on long-range station modernization programs where stations all along the line have been rebuilt and modernized. This is a big undertaking, one requiring large expenditures, and must be spread out over a period of time. Other railroads have concentrated on modernization of the more important stations. Certainly the railroads have seen the desirability of a long-range program of passenger-station modernization, but often the funds available limit the scope of the program.

Due to the varied conditions of climate, topography, traffic, materials and local requirements, it is rather difficult to describe general trends in the modernization of passenger stations; however, there seem to be some that are fairly consistent throughout the country. These will be mentioned in this report.

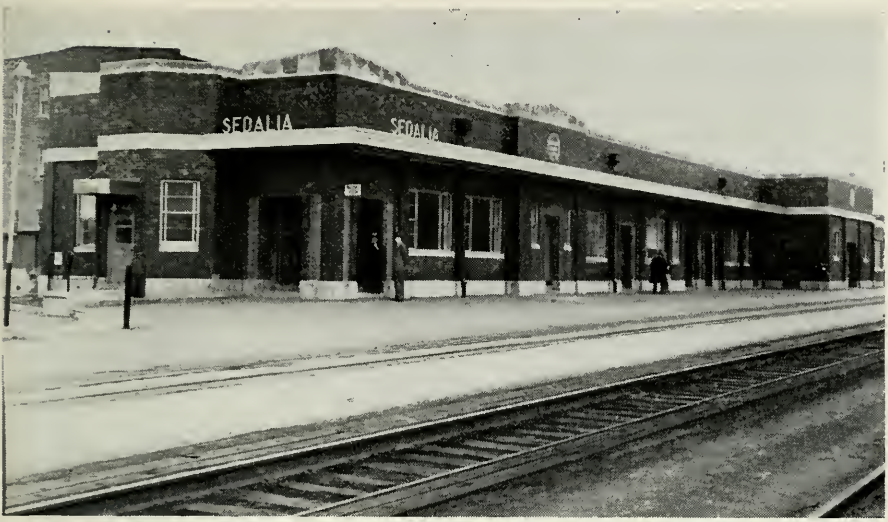
Railroad passenger stations may be classified as to type and size as large terminals, moderate size masonry buildings, and small frame combination passenger and freight stations. Each type has its particular problems, and what could be done in the way of modernization of one would not apply to another.

One of the most significant changes that has taken place during the modernization of passenger stations is the reduction in size. This is due to decreased passenger business and recognition of the fact that a railroad passenger station does not have to be a monumental structure.

Many of the older stations had two waiting rooms, one for men and one for women, separated by the ticket office. The recent trend is to provide one waiting room, with the ticket office usually at one end. The space formerly occupied by a waiting room has been utilized for freight and other types of offices, welfare facilities, Railway Express quarters, baggage rooms, and other useful purposes.

Exteriors

The exteriors of some of the larger brick and stone passenger stations have been left intact because their architectural design is still considered in good taste. These buildings have generally been improved on the exterior to the extent of replacing roofing, gutters, downspouts, doors and windows;



Modernized both inside and out, this station presents a far more attractive view. Work, completed in 1952, included removal of second story.

cleaning the masonry walls; and painting. The brick and stone work may be cleaned with steam, or by washing with a solution of muriatic acid. The appearance of many an old building is greatly enhanced by cleaning the masonry so that the beauty of the original materials may be seen. The proper use of color on doors, windows and trim to match or complement the masonry surface does much to improve the appearance of the structure.

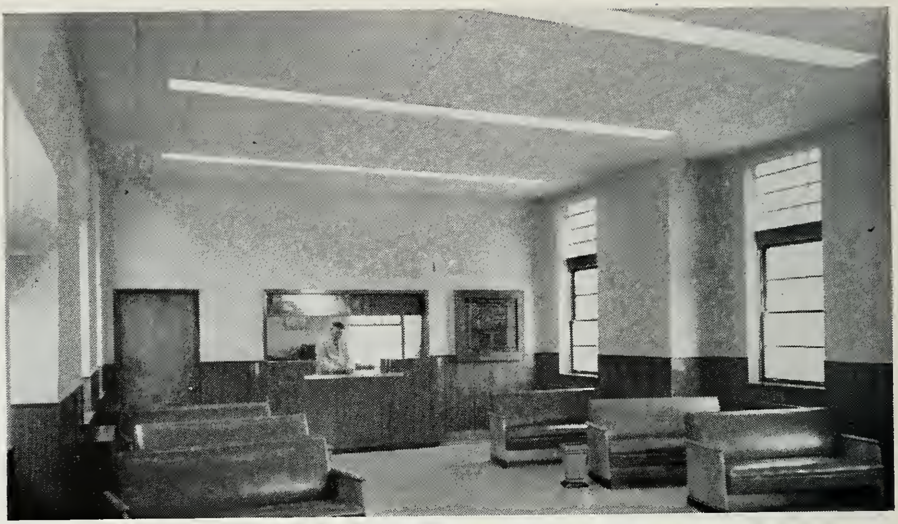
The large arched trainsheds at several large terminals have been removed and replaced with butterfly-type platform canopies. This results in reduced maintenance, and gives the platform better light and natural ventilation. Canopies and shelters have also been removed from many smaller passenger stations, where their continued maintenance is no longer justified.

Other larger or medium-sized masonry passenger stations have been completely modernized on the exteriors as well as inside. In some cases the gable roofs and over-hanging eaves have been removed and flat roofs constructed. In other cases the gable roof is left and the eaves cut back. Towers, dormers and cross gables may be removed to reduce roof maintenance and to give the roof an unbroken appearance. In some instances, a second or third floor has been removed, and bricks have been salvaged to build up the parapet walls. The larger overhanging eaves often did serve a useful purpose in sheltering the building from the elements, and several recently modernized passenger stations have incorporated the modern type flat roofed cantilevered canopies on portions of the building. Each building requires different architectural treatment because of the original and desired appearance.

Glass blocks have been used for a number of years in windows and for decoration. Aluminum window sash and doors have been on the market a short time, but they have already become popular materials in modernization of passenger stations.

Due to the difficulty of matching brickwork, it is often necessary to apply a new facing when modernizing masonry passenger stations. This is especially true where window and door openings have been altered. A variety of materials have been used for facing existing masonry construction, such as face brick, granite, limestone, stucco and asbestos-cement shingles.

The small frame passenger or combination stations are more numerous than the larger masonry stations. A few railroads have programs of remodeling these depots all along their lines, but most of the railroads are modernizing their stations at the more important locations or where the size may be reduced to eliminate maintenance. One road has almost completely rebuilt these smaller stations, replacing the timber foundations and floors with a concrete slab; reducing the size materially; utilizing the salvaged material for



Interior of the Chicago & North Western station at Kenosha, Wis., following modernization in 1948. Note flush lighting in tiled ceiling.

framing; and using new material for roofing, doors, windows, siding and interior lining.

One common method of modernizing old frame stations is to jack up the building, remove the old timber foundation and floor structure, and construct a new concrete foundation and floor slab. The lower 2 to 6 ft. of the studding is then cut off and the building lowered on to the new foundation. This provides an 8 to 10 ft. ceiling in place of the former high ceiling and also removes the lower portion of the studs which often are decayed. This operation improves the appearance of the building as well as reducing the amount of material required to modernize the interior and exterior. After the eaves are cut back and other alterations made to the old frame of the building, such as changes in the locations of windows, doors, and partitions, the building is ready for the application of new roofing and siding, and interior finishing.

Many types of exterior facing materials have been used with success on the exteriors of modernized frame passenger stations. Local environment, first cost, maintenance cost, and appearance are a few of the items that are taken into consideration for each particular job. The materials most frequently used are face brick, stone, stucco, wood siding, aluminum siding, or asbestos-cement siding shingles. When using stucco, aluminum siding, or asbestos-cement siding shingles, it is desirable to provide brick, stone, or wood siding up to the window-sill height to avoid damage to the siding material from baggage trucks, or other platform operations.

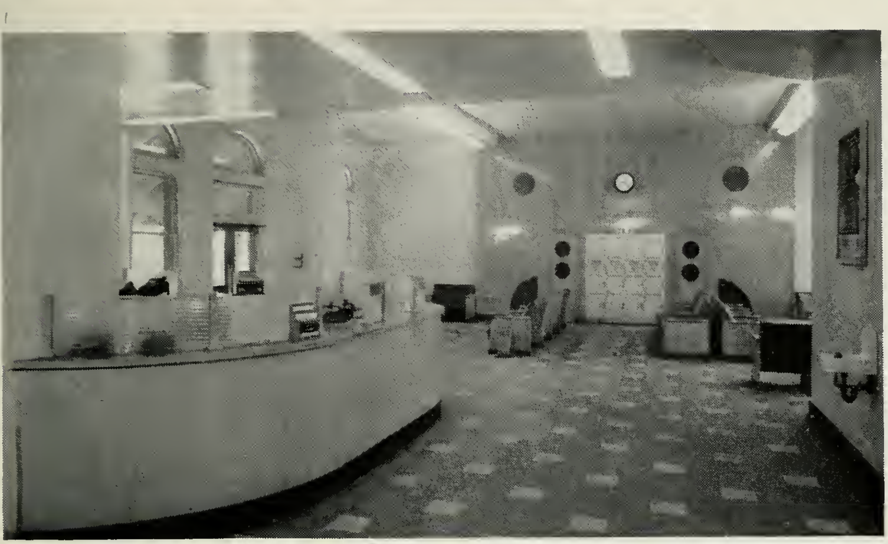
Roofing, on flat roofs, is invariably of the built-up type, either tar and gravel or smooth-surfaced asphalt. Gable roofs are usually covered with any of the several varieties of shingles, the most common being asbestos-cement shingles, heavy mineral-surfaced asphalt shingles, or asbestos-plastic shingles.

Station signs have also been brought up to date with several types of new materials that should reduce the necessity of frequent painting. Porcelain enamel signs and signs with plastic background and reflectorized lettering have been used on several railroads.

Interiors

There are several basic facilities that are found in the simplest of passenger stations, namely, waiting rooms, ticket offices, toilets and baggage rooms. Passenger terminals in larger locations require more auxiliary facilities such as electric drinking fountains, coin-operated dispensing machines, public address systems, phone booths, parcel-check lockers, newsstands, lunch rooms, soda fountains, dining rooms, kitchens, cocktail lounges, telegraph offices, other railroad offices, welfare facilities, moving stairways and freight rooms.

The recent trend is in the direction of one waiting room; lowered ceiling; and light, clean, simple interior features, free from fancy



View of the waiting room in the Green Bay, Wis., station of the Chicago & North Western. Station was completely modernized in 1946.

molding, that can be maintained with a minimum of effort. Waiting rooms are provided with drinking fountains, electric in the larger locations; and recessed phone booths and parcel check lockers.

Since the old type of wooden settee would not fit in with the modern waiting rooms, the trend has been to modern upholstered settees and single chairs arranged in an informal fashion. These settees and chairs have either wood, chrome-plated steel or aluminum frames, and may be had in a variety of colored leather or leatherette fabric upholstery. The upholstery is susceptible to damage by cigarettes, baggage, and sharp objects, but where proper supervision is maintained, little damage occurs. In the smaller stations, and where the waiting room is unattended for a period of time, several types of solid wood settees of modern design have been used.

The ticket office has come in for its share of modernization. Gone is the old brass grille that separated the patron from the ticket seller, and in its place has appeared the open-type or glass-type ticket window and counter. Where ticket sellers are on duty 24 hr. a day, it has been practical to do away with the solid partition between the waiting room and the ticket office. The ticket office is separated from the waiting room by a counter from 42 in. to 48 in. high. This counter may have a glass screen guard from 12 in. to 48 in. high, except at the selling space where an opening at least 24 in. wide is left. Where the ticket office must be closed at times, this open-type counter is not practical, and the ticket office is usually separated from the waiting room by a partition. The partition may be entirely of glass above the counter height, or it may be a solid partition with a large window that will slide out of the way so that an open, attractive selling space is provided. At other locations, it has been found desirable to provide a glass ticket window with a speak hole. The counters have been provided with the necessary cash, stamp, card ticket, inter-line ticket, ticket stock, file and tariff drawers, and folder racks. All of these drawers and racks are kept below the counter top. The old style upright ticket case is eliminated. The counters are usually covered with linoleum, tempered hardboard, or cigarette-proof plastic material.

One of the most common complaints with respect to the older passenger stations applied to the toilet rooms with their old out-of-date fixtures, stalls, floors, and walls that were not always of the most impervious materials, making cleaning difficult. The modern toilet room, if properly maintained, should eliminate the major portion of complaints. Toilet rooms are abused more than any other space in the passenger station, but it has been the experience at most locations that, where the toilet room is modern and clean, the traveling public will help keep it that way. Where sufficient water pressure is available, flush valve water closets should be used. The wall-hung type closet is frequently used to facilitate cleaning the floor, and invariably the elongated rim-bowl type with open-front black plastic seats are used. Urinals may be either wall-hung or floor type, depending on the local code and the architect's preference. Hot water for lavatories is generally furnished in only the larger modernized passenger stations.

Gravity or forced-exhaust ventilation is essential in all toilet rooms. The floors, walls and ceiling should be of an impervious material. Ceramic tile provides the best type of flooring, but terrazzo and concrete are also used. Walls and ceilings are generally plastered, and wainscotts of ceramic tile, glazed tile, marble or structural glass are generally provided. These latter materials clean easily and are almost always used in the larger passenger stations.

The many modern, as well as old reliable, materials afford the architect ample opportunity to provide interiors that are pleasing to the eye and easy to maintain. Of course, the materials are used on each particular job according to the importance of the location, the money available for modernization, and the architectural scheme.

Wood floors have generally been replaced, except in some small passenger stations where the floors are of maple, oak or pecan. Concrete is used, either plain gray or colored, in smaller stations; and asphalt tile, rubber tile, ceramic tile, quarry tile, terrazzo and oxychloride are used in the more important stations. Generally rubber or asphalt tile is used in the ticket office; terrazzo or oxychloride in the waiting room; and ceramic tile in the toilets of the larger passenger stations.

Most waiting rooms are provided with wainscotts. Here again the material selected by the architect depends on the importance of the station and the architectural scheme. Plaster, marble, structural glass, ceramic tile, hardwood plywoods, cement-asbestos board, tempered hardboard, and knotty pine are the most commonly used materials. The wainscott may be brought up to the window-sill height, or to top of the doors. Wainscotts in toilet rooms are generally carried to the top of the doors.

Wall surfaces in modernized passenger stations are usually brick, glazed tile, plaster, cement-asbestos board, tempered hardboard, knotty pine, fiber plank of gypsum board. Plaster is the most easily maintained. Hardboard, fiber plank and gypsum board are generally used only over old beaded ceilings in the smaller frame passenger stations.

Ceilings are generally plaster, fiber panel tiles or acoustical tiles. In many of the older stations, high ceilings exist and reverberation is excessive. Office and waiting-room ceilings may be lowered by the installation of fire-resistant acoustical tile suspended on steel channels, tie bars and splines. This affords a practical and economical method to lower the ceiling height and also provides a satisfactory structure for mounting light fixtures, as well as providing for the installation of thermal insulation. Lowered ceilings will give rooms an appearance of greater horizontal depth. A passenger station is generally a noisy place and the reduction of sound adds to the comfort of patrons and the efficiency of employees. Where lowered ceilings are not desirable, acoustical tile may be fastened to the existing ceilings to reduce noise. This produces a nice appearance and eliminates the cost of repainting for some time.

Painting and Decoration

The interior and exterior painting and decoration of passenger stations have been radically changed within recent years. Formerly, most railroads painted both the interiors and exteriors of their passenger stations with standard colors, which were often dreary colors designed to extend the period between painting, and not designed for appearance. The present trend is toward scientific color selection, using a variety of color schemes. A combination of proper lighting and painting can accomplish much in providing visual comfort and emotional relaxation for passengers and employees. A good psychological effect may be obtained by using different color schemes when redecorating.

There are many conditions that must be taken into consideration for the proper selection of color of materials and paints, some of the most important being visual, emotional comfort, exposure and ease of maintenance. Floor coverings are usually of a mixture of several colors, the darks predominating, such as black, red and brown, so that the floor will not show dirt so easily. Wainscotts of natural woods are usually finished natural and not with the dark stains and multiple coats of varnish that have been used in the past, hiding the beauty in the wood. Walls and ceilings are painted according to the use of the space and exposure. For waiting rooms with sunny exposures shades of green, acqua or blue are widely used. These colors will offset excessive sunlight, make the room seem cooler and complement the human complexion, thus flattering the appearance of the passenger. If the waiting room has a dark or north exposure, it may be given warmth by using ivory, cream, peach, beige, or soft yellow as these colors tend to offset the cold blueness of natural light and help make a friendly atmosphere. Ceilings are normally white or off white, for maximum light reflection.

Office colors may be of the same hue, but are usually of a grayer shade so as not to be too aggressive, monotonous and are easier to maintain. The brighter hues are preferred in toilet rooms as they seem to encourage cleanliness. Blue, green or rose are satisfactory choices. Corridors and stairways, which lack natural light, may be painted in soft tones of yellow, which give the space a sunny appearance.

Where funds are not available for complete modernization, a modern effect can often be achieved through the proper selection and location of color. Ceilings can be made to appear lower; obsolete decorations and gingerbread can be painted out to give a streamlined effect.

Color preferences vary considerably and in order to satisfy the townspeople one railroad cooperated with the chamber of commerce in conducting a contest where a prize was given for the passenger station color scheme. The winning colors were actually applied. Colors should be used properly by someone familiar with scientific color selection, as too often the wrong colors are chosen.

Lighting

Lighting standards have changed a great deal since most passenger stations were constructed. Invariably the old passenger stations were poorly lighted. In the process of modernization, the whole lighting system is generally completely revamped. Modern fixtures of the fluorescent type are universally used for general lighting with incandescent and spot lights used where function dictates. Fluorescent lighting offers many interesting possibilities such as cove, pattern and strip lighting. Fixtures may be flush mounted, recessed, or hung, depending on the height of the ceiling. Conduits are now specified by most codes and replace the old open wiring. The recessing of conduits behind the plaster, or other wall surface, is preferred.

The larger passenger stations usually have signs designating various facilities and directions. These signs may be neon or plastic letters lighted by a fluorescent tube.

Station platform lighting has been greatly improved in some station modernizations. The usual exposed incandescent gooseneck light on a wood or pipe post has been replaced by modern incandescent or mercury vapor fixtures. The ample light provided by these fixtures has caused many favorable comments, and makes the station and station grounds a most impressive site at night.

Heating

Most of the larger passenger stations are heated with steam. These plants have often been altered depending on the scope of the modernization and the condition of the original plant.

Many of the stations had hand-fired boilers. These boilers are usually either converted to oil or gas, or new oil or gas boilers are installed. Automatic plants of these types are especially important since the advent of the 40-hr. week. The use of gas or oil eliminates dust from coal and ash handling.

One-pipe steam systems were the practice when the majority of these heating systems were installed, and in many cases two-pipe systems have been installed to replace them. Piping is concealed wherever possible, usually under the floor. If piping is exposed, it should be insulated to reduce dirt streaks on walls and ceilings.

The old style cast-iron radiators have generally been replaced with convector radiators. These convectors may be recessed into the wall where conditions permit in large waiting rooms, or other spaces, unit heaters or hot blast coils may be used in lieu of radiators. Radiant heating has become popular in new buildings, but it does not ordinarily lend itself to applications in modernized passenger stations.

Many of the small passenger stations were formerly heated with coal stoves. These are always removed in the modernization work. If the building is small, oil-fired space heaters may suffice; and in some locations gas-fired unit heaters are a good solution to the heating problem.

Where a complete new heating plant is installed in modernized passenger stations, the forced hot-water system is very popular. Forced hot water systems are not recommended with any but automatic type plants, and the proper safety devices must be installed to protect the boiler from damage.

Waiting rooms and lunch rooms have been air-conditioned in several passenger stations. While air-conditioning is desirable at certain times of the year in most locations, it is often difficult to justify the expense involved. Large units with high operating costs are required for peak loads. Recent progress in the field of air conditioning should make air conditioning of passenger stations more economical.

It is standard practice to provide roof or attic insulation in modernized stations to reduce excessive heat losses in winter and heat gain in summer. Proper attic ventilation must be provided when insulation is installed.

Platforms

The older station platforms were generally constructed of wood, brick, screenings or chats. Since platforms of wood, screenings or chats are a source of constant maintenance, they are usually replaced with portland cement concrete or asphaltic concrete. If proper care is taken in providing a good foundation, and if the well-known rules for proportioning, mixing, placing, and curing concrete are followed, a durable platform will result; however, in all too many cases these rules have not been followed and concrete platforms less than 10 years old are showing signs of deterioration.

Station Grounds

In order to provide a complete job of passenger-station modernization it is important to improve the station grounds. Oftentimes large parks were provided adjacent to the station and through the years these properties have usually been neglected. The size of the park can often be reduced, proper landscaping, including evergreens and shrubs, placed near the building, and the remainder of the area turned over to automobile parking. Most cities urgently need additional parking facilities, and are often glad to share in the cost of paving the parking area, leasing, or even purchasing the property from the railroad, and constructing the parking facilities at their own expense.

Modernization work is carried on differently on each railroad; however, the larger buildings are usually done by contract while the smaller modernizations are usually done by bridge and building forces. When doing a complete job of modernization it is often desirable to provide a temporary station facility so that work may progress without interruption. Platform shelters, car bodies, baggage rooms, or other temporary structures are some of the facilities used. Where temporary facilities are not feasible, the architect may be able to plan the work in stages so that the various station facilities may be used without interruption.

Each passenger station presents its own problems and it is obvious that no two stations could be modernized in the same manner; however, the recent trend is to smaller, simple, clean, well-lighted, attractively painted and easily maintained structures.

Discussion

W. A. Huckstep (MP) stated that his road began a program some time ago on the modernization of the toilet rooms of passenger stations, which was carried out entirely by railroad forces. Black glazed tile, from the floor board to the 7-ft. line, is now his road's standard for walls of depot toilet rooms, he said. E. H. Barnhart (B&O) suggested that the installation of an automatic pump and a cesspool will permit the modernization of the small stations at outlying points.

Referring to the cleaning of station interiors, V. D. Raessler (IC) asked to what extent could muriatic acid be used to clean paint off masonry. G. E. Detzel (George E. Detzel Co.) said that muriatic acid would not cut paint and that burning and scraping the paint off, a method used by the B&O, seemed to be the better way. Soft brick, he continued, has to be replaced and this poses a problem of getting replacement brick of matching color. Cleaning by muriatic acid, he said, must be confined to limestone masonry buildings. On this same subject, F. O. Caldwell (SAL) warned that acid cleaners must be used with care because hydrofluoric acid will permanently damage the glass of windows.

Inspection and Maintenance of Water Tanks

Report of Committee

COMMITTEE—J. H. STINEBAUGH, *Chairman,* supv. w.s., I.C., Carbondale, Ill.; J. J. SHARKEY, *Vice-Chairman,* gen. foreman b.& b., Pennsylvania, Bradley Beach, N. J.; J. M. SHORT, *Vice-Chairman,* gen. w.s. insp., T.& P., Dallas, Tex.; H. M. DICK, supv. struct., P.R.R., Harrisburg, Pa.; E. M. ENGER, supv. b.& b., C.St.P.M.& O., St. Paul, Minn.; J. A. JORLETT, asst. engr., P.R.R., New York, N. Y.; G. E. MARTIN, supt. w.s., I.C., Chicago, Ill.; E. R. SCHLAF, asst. supt. w.s., I.C., Chicago, Ill.; J. P. WITHERSPOON, asst. mast. carp., S.A.L., Atlanta, Ga.

The locomotive water-supply storage tank is an important facility on any railroad using steam locomotives. Many roads have gone extensively to the use of diesel power; however, few have dieselized completely, and if there is further need for the water-storage tank it should be maintained properly to prevent failures that might cause inconvenience and possible injuries. We frequently hear and read about complete failures of water tanks—not always located on railroads—with serious results, indicating possible lack of maintenance and inspection. Where change of motive power, from steam to diesel, is being made it is felt that more frequent and careful inspection is desirable. This, coupled with good judgment on keeping tanks in serviceable condition, will be all that is required during the transition period.

The purpose of inspecting water tanks is to provide information as to their condition. An inspection report should be used that will provide complete information on the physical condition of each tank. When the inspector notices a condition that needs attention, but is not covered on the report form used, he should make appropriate comments in the remarks column. The report should cover the condition of one tank exclusively, taking care to designate its proper location. It is considered advisable that the individual making report of inspection should call special attention, in letter of transmittal to officers in charge, to any condition found that requires attention before the next inspection time.

Wood Tanks

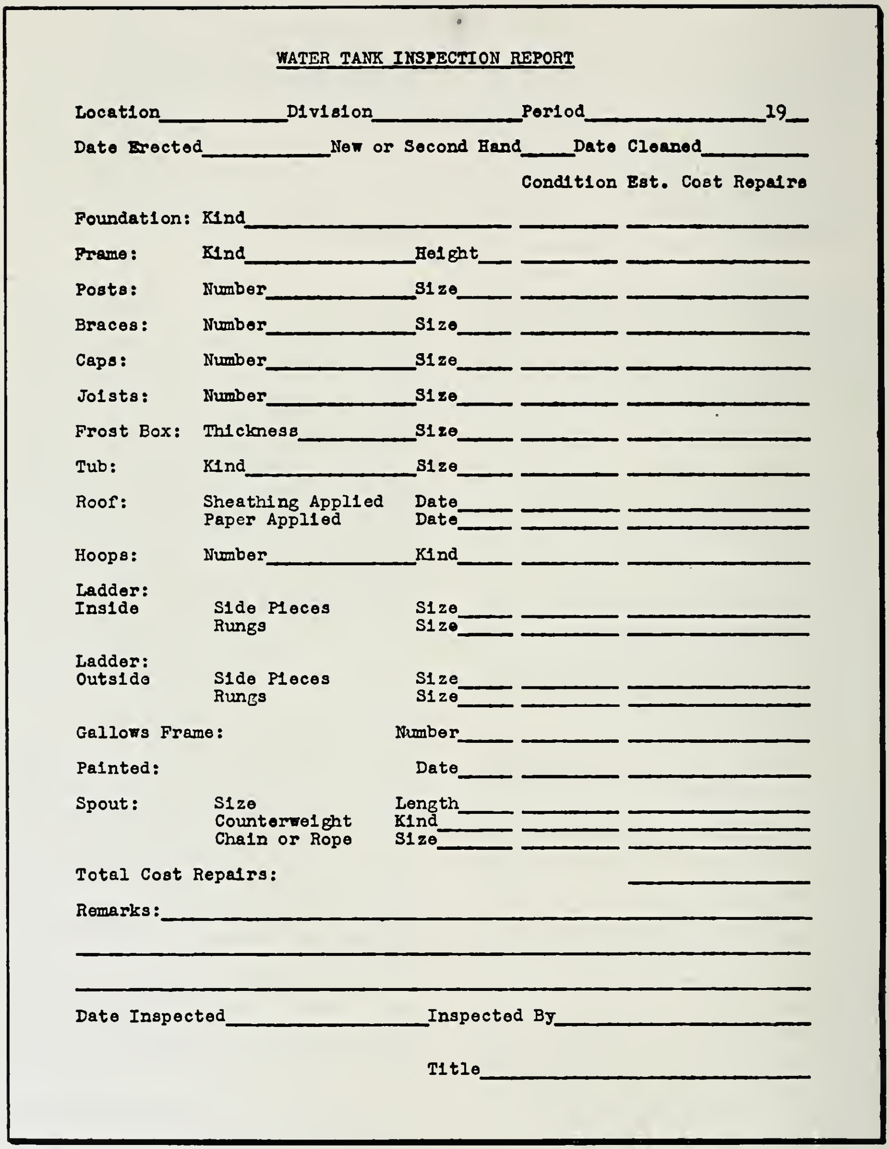
Most wood water tanks are built circular in form, and since the quality of material used for construction of tanks has considerable bearing on their life and the maintenance required, the hoop steel and timber should have adequate inspection to ascertain that they meet specifications. Likewise, since the construction of the tank affects the life and maintenance, the work should be performed by qualified men. A foreman, or a qualified inspector with tank-erection experience, should supervise the construction. This will prove economical and beneficial to the life of the tank especially in connection with the placing and setting of the staves. Considerable skill is required to get the proper number of staves in relation to the bottom boards, so that all joints will close simultaneously. Many tanks are constructed with too few staves which will not permit closure of cracks near bottom boards, and there is no good way to correct this condition once the tank is completed. This causes leakage which results in conditions that will reduce the service life of the tank.

This report will deal mainly with the tank after it is constructed. The wood tank should be inspected at least twice a year. A fall inspection will reveal the repairs that are required, which will be included in the following years' budget. Most annual budgets are prepared the latter part of the year. The fall inspection will also reveal emergency repairs which are required to carry the tank through the winter without inconvenience to operation. The second inspection should take place in early spring. It can then be ascertained if all repairs required were included in the budget so that proper material for repairs may be secured.

The accompanying form of inspection report for wood tanks, which is used by one of the midwestern roads, indicates information that should be shown on inspection made by the officer charged with the responsibility of tank maintenance.

Making the Inspection

Concrete foundations can be inspected almost at a glance and, except in cases of inferior materials or poor construction, com-



WATER TANK INSPECTION REPORT

Location__________ Division__________ Period__________ 19__

Date Erected__________ New or Second Hand____ Date Cleaned__________

			Condition	Est. Cost Repairs
Foundation:	Kind			
Frame:	Kind	Height		
Posts:	Number	Size		
Braces:	Number	Size		
Caps:	Number	Size		
Joists:	Number	Size		
Frost Box:	Thickness	Size		
Tub:	Kind	Size		
Roof:	Sheathing Applied Paper Applied	Date Date		
Hoops:	Number	Kind		
Ladder: Inside	Side Pieces Rungs	Size Size		
Ladder: Outside	Side Pieces Rungs	Size Size		
Gallows Frame:		Number		
Painted:		Date		
Spout:	Size Counterweight Chain or Rope	Length Kind Size		
Total Cost Repairs:				

Remarks:____________________

Date Inspected__________ Inspected By__________

Title__________

plete rebuilding is seldom necessary. Surface disintegration, caused by freezing and thawing, can be arrested by chipping away the damaged portion and pouring a jacket equal to the amount of concrete removed, after which the application of waterproofing is recommended. The frequency of inspection of the underground portion of timber foundations will depend on local conditions. The above-ground timbers should be closely and carefully inspected and maintained in first-class condition. Treated timber is recommended for this part of the structure.

The frame, floor joists and bottom boards, particularly, should be carefully inspected. Care must be exercised in the sizing of replacement timbers, in order to insure an even load distribution.

The frost box should be inspected to determine its efficiency in preventing frozen water lines. Frost boxes are highly susceptible to deterioration from the inside; therefore, the inspection of the interior should be thorough. Proper ventilation when temperature is above freezing will prolong the life of frost boxes.

There are local conditions that cause a considerable amount of concern with respect to wood water tanks in the northwest region, and a great many of the older installations of wood tubs in this region were constructed with insulated wood ceilings at the top of the staves, over which a pitched roof was installed, with a view toward retarding the icing of the interior of the tanks during severe weather. It has been found that these old-style ceilings are especially susceptible to decay and damage from ice, therefore requiring frequent inspections.

Field glasses are very beneficial in inspecting the staves and hoops. However, if there is any question as to their condition a boatswain's chair should be used for a more detailed inspection. Round hoops are in general use at this time and their physical condition can be determined by a close inspection. The condition of tank hoop lugs should be noted, particularly in cold climates, as frequently they are damaged from freezing. The hoop nuts should also be inspected closely because corrosion occurs more extensively here than on the hoop. The nuts can be protected either by the application of paint or some grease compound. Badly deteriorated nuts could result in complete failure of the tank.

In the interest of safety, the ladders should be carefully inspected for bad splices, loose rungs, and rotten or loose braces. The inside ladder tends to rot rapidly at the water level and should be given special attention. When wood tanks are located in yards, they are frequently used to support floodlights. The condition of platforms, ladders, mountings and wiring should be given attention during the regular inspection of the roof.

How to Stop Leaks

Water service maintenance men have employed many ingenious methods of stopping leaks in wood tanks. New tanks sometimes leak through the floor boards. This can be stopped by draining the tank and spreading 2 or 3 in. of clay over the floor, refilling the tank slowly so the clay will not be greatly disturbed. The water passing through the clay carries enough of it in suspension to plug the pores in the wood. If leaking around the chime occurs, fine rotton cinders mixed with powdered clay or cement introduced into the tank, without draining, near the leak, through a 2-in. or 3-in. pipe from the hatchway, will usually stop it immediately. Dry sawdust poured on the surface of the water has been used effectively to stop leaks between the staves.

The above will stop most of the minor leaking troubles; however, if the entire outer stave surface appears wet and considerable dripping is in evidence, the hoops should be tightened, or cracks caulked. No attempt should be made to caulk leaks in the chime, as this will usually make them worse; furthermore, ice will tend to pull out the caulking. Care must be exercised in the use of sealing compound for application inside wood tanks, as this method of securing a dry tank is merely temporary, in that the wood is isolated from the water within the tank causing ultimate shrinkage of the wooden staves and loosening of the hoops and caulking.

Painting untreated wood tanks improves appearance, but helps little toward extending the life of the wood parts. Brace rods, hoops and other metal parts should be protected from corrosion.

Steel Tanks

Detailed inspection of the interiors of steel tanks should be made at least every five years. Local conditions, such as the character of the water supply and atmospheric conditions, will govern the necessity of more frequent inspections. When the interior of the tank is to be inspected it should be drained and washed down, and special attention given the inside ladder for weakened side pieces, rungs and anchor bolts. The riser should be inspected for pitting and loose rivets. Extensive welding of sheets is not recommended; replacement of entire sheets is preferable. Sheet rivets do most of their work in shear and not much in tension; therefore, so long as a rivet remains tight, it need not be replaced.

When cathodic protection is properly installed and maintained, painting the interior of steel tanks is done less frequently. However, the shell should be painted from the top to a point 5 or 6 ft. below water level. When cathodic protection is provided the meters should be checked once or twice a month to see that the proper amperage is maintained. The inspection should also include the condition of the anodes, as well as their supports, and the general condition of wiring and other electrical apparatus. Frequently this equipment is damaged when ice forms in the tub, and during sleet or heavy windstorms.

Anchor bolts and post shoes should be inspected for corrosion. Coal, cinders or rubbish should not be allowed to accumulate around the base of steel tanks. Tower posts should be checked for alinement, tower rods for adjustment, and foundations for settlement. If tower rods need adjustment, the tank must be drained. It is very important that two cotter pins, well spread, be in place in all long pins and one cotter pin, well spread, in each set-up pin. If rod pins with nuts are used, the nuts should be tight and threads well battered. If cotter pins or nuts are not in place, pins may come out, permitting tank bracing to loosen, resulting in collapse of the structure. All bolts and rivets should be in place in the tower and balcony, and special attention given the balcony floor and hand rail.

The roof should be inspected closely, especially in the vicinity of the finial, and the inspector should pay particular attention to the revolving ladder.

The spider rods are intended for construction purposes only; however, in many cases automatic valve floats and scaffolds are suspended from them. If used they should be maintained; if not used, and found to be dangerous, they should be removed and need not be replaced.

In some cases considerable trouble from exterior pitting and rusting is encountered, especially on steel tanks supplied with well or other cold water, causing the tub to sweat. These tanks can be cleaned and painted in the fall, after the temperature drops to a point where the tank does not sweat.

The older tanks require closer examination than the newer structures. However, all tanks should have semi-annual inspections to make sure that they are in safe operating condition at all times.

Discussion

W. A. Huckstep (MP) began the discussion by telling of a lining material that is available for stopping leaks in wood tanks and in badly pitted steel tanks. President Martin commented that the principle of using tank linings is not very good because freezing and thawing are harmful to them.

Several members commented on the need for roofs on water tanks and how to cover the valve mechanisms of open-top tanks. This was followed by a discussion on the methods used for stopping leaks at the chimes of wood tanks, which included comments on concrete false bottoms and the use of clay layers on the bottom planks.

Restoring and Prolonging Life of Masonry Structures

Report of Committee

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This report will limit itself principally to culverts and bridges built with either stone, brick, or concrete masonry. It will include maintenance or repair work by pointing, grouting, patching, encasements, and metal lining. The methods and practices described should suggest applications for numerous other masonry structures such as stations, motive power facilities, shops, tunnels, and waterfront facilities.

Most American and Canadian railroads have numerous stone box and arch culverts dating to the earliest construction of the roadway. Some of these have passed the century mark and many are approaching it. Some of these are of the dry type construction where the stones were carefully cut and placed in position. Others were built using natural or portland cement mortar as a jointing material.

In the latter type disintegrated mortar allows the stones to loosen and sometimes be displaced or broken. The old mortar should be carefully raked out. It will be found desirable to repair all joints at the same time. Such joints should have the mortar removed for a depth of at least twice the width of the joint but not less than one inch. All loose, unsound, or disintegrated stone should be removed to allow placing a minimum depth of 4 in. of concrete, properly bonded to existing masonry.

Hand chisels and hammers are the usual tools used for this work but it will often be found cheaper and less irksome to use pneumatic chippers. Compressed air is further useful for cleaning dust and dirt from the stone surfaces. When the depth of the joints exceeds several inches, a force pump—either hand or air powered—is more efficient for washing out loose material and for proper wetting of the stone. The cleaned stone should be thoroughly wetted with clean water before any pointing is attempted.

Satisfactory mortar is made from standard portland cement or mortar cement and sand that is clean, screened, and graded to meet specifications for concrete. A good mixture is one part cement to three parts sand, dry volume. Water, free from impurities such as acids, alkalies, silt, or organic matter, and at a rate of about 5 gal. per sack of cement, should be mixed thoroughly with the dry materials. The amount of water will vary according to the graduation of the sand, moisture content of sand, and absorptive properties of the stone. It is desirable to hold the water content low so as to produce a strong mortar and to reduce shrinkage of mortar in the joints.

Enough mortar should be mixed to last for 20 to 40 min. working time. Good mortar possesses a high water-retaining capacity and plasticity. Many prefer to let the mortar stand about a half hour before using. Mortar bonds best to stone when it is soft and plastic and does not stiffen quickly when worked in the joint.

The mortar must be packed in the wetted joints tightly. Before it hardens it should be worked with a round tool which is slightly larger than the joint. Use sufficient force to press the mortar tightly against the stone. A joint tooled in this manner lasts longer because it is more resistant to moisture. Other types of tooled joints are more decorative, particularly for head and wing walls, but they may form shelves that retain water which is apt to cause trouble.

When disintegration of masonry has advanced so that stones are moving on each other and water is leaking through, pressure grouting is used to consolidate the structure. Investigations are first conducted to learn if the movement is due to foundation failures or voids in the masonry. In the latter case holes are drilled to study the conditions inside the masonry. Foundation failures will not be treated in this paper.

The diameter of the holes should be not less than 1½ in. The drilling pattern will depend on the size of the stones and the degree of failure of the joints. After it is determined that voids are causing the trouble, a pattern of drilling will include a hole for each 16 to 25 sq. ft. of surface. Holes in each row are staggered with those in adjoining rows. Drilling plenty of grouting holes assures filling the voids later.

The depth of the holes is governed by at least two factors. When excessive leakage exists, it is desirable to build a blanket of grout at the back of the wall or arch, and holes are drilled entirely through the wall. When voids are the principal cause of trouble the purpose is to drill grouting holes deep enough to enter them. The holes should be drilled at an angle of 90 deg. to the face of the masonry. When it is necessary to penetrate footings they will have to be drilled at an angle. Rotating pneumatic rock drills are the common tools. In stone masonry drilling, jamming of the drills occurs frequently when the drills enter interior joints. When this occurs, time can be saved by drilling a new hole and abandoning the old hole and drill.

Clear water is often pumped into the holes before grouting in order to wash out dirt and other fine material and to get a clue for the proper consistency of the grout. A record plan for identifying the holes will be found useful when this is done. The quantity of water used in washing, the holes from which it escapes, the appearance of the water—in other words, any thing which offers a clue as to the interior of the structure—should be noted and recorded.

There is a difference of opinion as to the benefit obtained by flushing holes. Many believe that water carries the fine material to the bottom of the voids and prevents the entrance of the grout. Others say that if this is suspected, additional holes can be drilled after the initial grouting is done, and the trapped fines can be then washed out, followed by more grouting.

The selection of the grout mixture is of utmost importance. An ideal grout must do the following:

(1) Flow through small passageways without plugging.

(2) Flow through small passageways without high frictional resistance.

(3) Maintain the solid portions in suspension without separation or agglomeration of solid particles during the grouting operation.

(4) Maintain the solids in suspension without appreciable settlement, in a cavity filled with fresh grout, and hence without appreciable water gain until the grout has set, and subsequently harden without appreciable shrinkage so that the cavity will remain completely filled with hardened grout.

(5) Remain at substantially the same degree of plasticity for an hour or more after the first addition of the water to the mixture.

(6) Bond with the surrounding concrete and provide strength comparable to that of the surrounding masonry.

Neat grout of cement and water will not flow freely into voids smaller than three times the largest cement particles. Based on the 0.0028 - in. opening in the 200 - mesh screen, this would be 0.0084-in. The portland cement and other finely pulverized material, if used, must meet the limit that not less than 90 per cent pass a 200-mesh screen.

Except in the case of large cavities, where thick mortar or concrete can be placed, a mortar of varying proportions of sand up to a 1:1 mix by volume can be used. The water requirements for quality should meet that for mortar and concrete; for quantity, the variance will be from 5 gal. to a maximum of 12 gal. per sack of cement. When grout is being placed over an extended period, the water-cement ratio should be kept low.

When sand is used it must be concrete grade and pass a No. 28 sieve. A large proportion of it should contain fines passing the 50 and 100-mesh sieves. Coarser particles will settle out of suspension, readily lose their coating of cement paste, and cause sticking and clogging in delivery lines.

Many have used grout made of cement and water or added sand for large volume of pressure grouting. Others seek improved qualities by use of added ingredients. Air-entrained cement or air - entraining agents added to portland cement is one medium. Many admixtures which serve to impart collodial properties to the mortar are available and they increase the dispersion of the cement particles, improve the coating of the sand grains, delay the setting period or accelerate it where traffic conditions warrant, and neutralize the shrinking characteristics; thus improving the permanency of the work.

Proper mixing of grout is important. It is sometimes done in a water-tight metal pan but this is awkward when the consistency of grout is thin. Small concrete mixers, hand or motor powered, are useful. The clearances back of the mixing blades must be closed and splash plates fixed at the discharge chutes to get successful mixing.

It is advisable to screen all grout before placing. It is an advantage to discharge grout into a tank equipped with an agitator as this assures a continuous supply for the grouting operation. The outlet from such a tank should be placed at the low point so the fresh grout will not be used before all the the older batch is run out.

Contractors specializing in this work have mixers with twin open-top tanks. The mixture is agitated by paddles set in a horizontal plane. Air motors drive the paddles but any type of propulsion is adaptable. One advantage of this machine is that one batch can be prepared while the other is still in the process of being mixed.

When sand is used, the dry materials are sometimes prepared on a platform adjacent to mixers so that the mixtures can be shoveled or scraped into the tanks. Another type of mixer is an open-end tank, about 2 cu. yd. capacity, which has an air line built into the bottom. Escaping air keeps the mixture agitated.

The various methods of pressure grouting masonry are gravity, pneumatic placement, and pumping. The gravity method may be used where the grouting equipment is located high enough above the point of application to give the necessary pressure. It does not lend itself readily to a wide range of pressures. A specification suggests a maximum height of 50 ft. and use of 2½-in. fire hose.

Pneumatic placing machines were used for some of the earliest work and are still employed. Tanks of about 30 gal. capacity are fitted with air supply and release lines, agitator, grout feed and discharge. Grout is forced by air pressure through rubber hose to the place of deposit, taking care to get an even flow and to cut off the air so that flow ceases before the grout supply is exhausted. The latter is difficult to control and air is generally forced into the void area. Shotcrete machines are sometimes used and they are operated in a similar manner to that above.

Some find the pump of the double-acting flexible reciprocating type more desirable. This machine utilizes piston pressure to move the mixture through the hose or pipe lines. Air or other power operates the machinery. The cylinders of this pump have renewable liners which are readily replaced. An advantage of this pump is the steadier flow of grout which is more effective in fine seam work than the intermittent flow produced by pneumatic pressure.

Placing of the grout in the structure is done, usually, through nipples securely fastened in the drilled holes, or by inserts. The latter consists of a pipe suited to the depth of hole being worked. At the end of the pipe is a rubber expanding ring. A hollow externally threaded rod is inserted in the pipe and through the ring. The insert is put in the hole to the desired depth and the ring expanded against the side of the hole. Thus, grouting can be done at any position.

There are differences of opinion regarding whether the order of grouting holes from top to bottom or vice versa is important. If air and water escape, grouting should be effective whichever order is followed.

As the action of the washing water is studied from the previously prepared record plan, so should the behaviour of the grout at the various holes be noted and studied. Knowing the depth of the hole, the position of the insert, the amount of grout placed, the action of escape of grout from other holes, accurate conclusions as to what is happening behind the face of the masonry can be made.

Pressure grouting has been similarly successful in prolonging life of masonry piers, abutments, and wing-walls. Great care must be used in this work to avoid raising coping stones from their beds. Cracks in concrete structures are further cases where pressure grouting has ben useful.

After grouting of stone masonry structures has been completed all joints should be pointed as described earlier in this report.

Concrete structures of all kinds, some built in the early days of this century down to those built in the 'thirties, have frequently been restored by patching or complete encasement.

The following rules and methods should be closely followed in patching work.

(1) All unsound concrete must be carefully removed and the exposed area must be cleaned of loose particles.

(2) The depth and extent of the patch will govern the use of dowels, expansion rods, or reinforcing. Careful anchorage of dowel bars should be provided. They must be grouted and left undisturbed for 24 hr., particularly if the patch will be in tension or shear.

(3) As in pointing and grouting, thorough soaking of the surface with clean water is very essential.

(4) Try to make a mixture of concrete that is similar to the base structure. In a large patch use coarse aggregate of about ¾ in. maximum size. If this is impractical, use pea gravel when possible. Sand and cement must be in accordance with standard concrete specifications.

(5) Shrinkage and bonding is the key to successful patching. All mortar and concrete mixtures shrink upon drying and when used in reintegration work this can cause complete failure. Many materials, such as metallic aggregates, air-entraining compounds, admixtures of fillers and lubricants, all of which compensate for shrinkage due to water loss, aid in making a uniform and strong bond between the contact surfaces.

(6) Proper mixing, as usual, is important. No tampering with partially set mixtures should be allowed.

(7) A slush coat is generally applied. This should be of the same mixture as the patching material; except, of course, omitting the gravel. The slushing mixture should be allowed to stand from one-half hour to three hours, depending on materials used. It should be applied in a ¼-in. layer. The following layer must follow before the slush coat dries.

(8) If layer build up is employed, the layers should be about ¼-in. thick. Very little floating or trowelling should be done as this disturbs the underlying layers which are in the setting stages. If formwork is used, the mixture must be rammed in solidly and vibrated if at all possible.

(9) Surface of patches should be kept damp for several days if standard portland cement is used. High-early-strength cement will require one or two days curing. Many surface coating materials are available; these will be found advantageous for vertical or overhead surfaces.

Frequently the disintegration of the brick, stone, or concrete masonry has progressed to the extent that the load-carrying capacity of the structure is reduced, and the original area must be restored or a lining constructed.

Again all the defective parts must be removed. If this endangers the structure, proper shoring must be done. Preliminary patching is sometimes necessary. Proper design for reinforcing must be followed and the anchorage carefully done. Forms are constructed as required and the concrete placed either by chuting or ramming. A concrete placing pump is useful for this work. It operates in a manner similar to the reciprocating grout pump, forcing concrete through steel pipes in a continuous flow with no segregation of materials.

On several railroads linings have been successfully placed by using the Instrusion-Prepakt method. After the form is built, gravel of proper gradation is packed in place behind the form. Inserts are then spaced throughout the form and a grouting mixture is pumped into the form completely enveloping the gravel. This type of grouting can also be done in underwater structures. The company specializing in this work uses several proprietary materials to control shrinkage and gain dispersement of the cement particles. This increases bonding, reduces shrinkage cracks, gives a dense surface, with no loss of strength in concrete. Plugging of grout lines is kept down as evidenced from some jobs when continuous grouting of several days' duration has been accomplished.

An older method of placing concrete type linings, long in use by railroads, is the shotcrete process. This is a pneumatic application in which no formwork is required. The surfaces are prepared as before; reinforcing materials including wire mesh are placed. A mixture of dry sand and cement is blown from a nozzle simultaneously with a spray of water. Mixing occurs as the two travel through some three to four feet of space and impinge on the surface. Layers up to 2 in. can be applied and the operation continued provided the underlying layer is given time to set. Continuous curing and adequate wetting before application of succeeding coats must be done. Some rebound of the heavier cement coated particles takes place. This material is waste.

An air compressor having a minimum capacity of 110 cu. ft., a concrete mixer, screening equipment, and a specially designed pressure tank called a shotcrete machine comprise the equipment. Simply expressed the special tank is a double chambered receptacle; one chamber superimposed on the other. The tank is charged with dry materials at the top. An air-tight gate between the chambers permits the dry mixture in the lower chamber to be blown out while the top is being charged. This charge can then be dropped into the lower chamber while the mixture is being forced out through a rubber hose without disturbing the placing of the shotcrete.

Standard portland cement and a fine aggregate is used. Sand should pass a No. 4 sieve, with the large percentage passing the No. 50 and No. 100 sieves. The fineness modulus should be between 2.25 and 2.75. It is mixed dry as stated. The water of hydration introduced at the nozzle is controlled by the behaviour of the mixture at the applied surface. If too wet, the layer will peel; if too dry, rebound will be excessive. A skillful operator is essential for this work.

Metal pipe, sectional plates, or liner plates may be used to restore damaged surfaces or increase load capacity of structure when encasement or other methods of repair are not feasible. These are manufactured in many thicknesses and shapes, and are designed to carry modern trainloads and fills up to 100 ft. in height. These materials are heavily galvanized and can be had with a protective material on the exposed surfaces. Installation is relatively simple. To integrate these structures with the original structure, openings are left in the linings and grout is forced between the surfaces.

Encasement of structures with reinforced concrete has been applied in many designs. Devices of clamps, ties, and straps are used to prevent spreading of arch rings, parapet walls, cracking piers and bearing pedestals. Large stones in masonry structures can be tied together with bars which are preheated and placed in drilled holes in stones. On cooling, the bars shrink and tie the stones together tightly.

Moisture is the great enemy of masonry structures built in temperate and frigid regions. Within recent years coatings have been developed to fill pore spaces in masonry. These materials are called silicones. They are colorless and can be brushed or sprayed on any surface. Black mastic materials have been applied as a layer on horizontal surfaces of piers and abutments for retarding moisture damage.

In conclusion it should be stated that continuous study is being carried on regarding the impairment of masonry structures. The results of these studies will enable bridge and building men to devise new ways to restore these structures. No attempt was made in this report to mention the reasons for the damage to the structures, to evaluate the different methods of restoring the damaged sections, or to discuss the economies for the restoration.

Discussion

M. Coburn (PRR, ret.) stated he didn't think that flushing of a hole prior to grout injection would result in as "tight" a job as using grout in a dry hole. Holes should be bored through abutments to fill up defects in the rear, he said, and the drilling pattern is actually a "cut-and-try" proposition. Good results for hand patching can be obtained by mixing the materials into a hard mud ball to be rammed into place, he added. Lee Mayfield (MP) expressed the belief that grouting holes should also be drilled through piers because the interiors often contain many large voids that should be filled.

B. I. Warner (Me. Cen.) said he points up the joints with a stiff mortar before injecting grout in the holes, thereby obtaining best results. J. S. Hancock (DT&I) stated that too often poor stone is not cut back far enough before patching. It would be better to cut these holes deeper than seems to be necessary, he said, and to apply a good waterproofing compound over fresh concrete to slow up drying, thereby preventing cracks.

Maintenance of Track Scales

Report of Committee

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Generally, scale men are called "scale inspectors" but, actually, they should be better known as "field service maintenance and installation engineers." They are the men who have had the practical experience with problems encountered in actual use of scale equipment. These men must have thorough knowledge of the theory and principles of scales.

The installation of scales has always been one of the field man's principal duties. No matter how good a scale may be, if improperly installed, it will be a source of trouble. It is certainly to the interest of the field engineer to insist upon proper installation. When called upon to service scales which are improperly installed, field men certainly have a problem.

Importance of Cleanliness

One of the most scientific approaches to scale maintenance is periodic service. This type of service actually saves the railroad money. After a scale is properly installed, the next step is to keep it clean. Cleanliness is nowhere more important than in the maintenance of scales as dirt, as much so as wear, causes excessive friction. To assure cleanliness and proper maintenance in general, there should be a maintenance program in which the field engineer will play the most important part as to instructing the workmen assigned to the maintenance and care of the scales. It will also be his duty to follow through and see that instructions are carried out.

There are many details that could be mentioned in maintaining track scales, some of the more important of which are outlined in this report.

Scale pivots and bearings should be protected with grease. Weigh rails and approach rails should be properly anchored to prevent binding. The deck should be so constructed to afford good drainage and to eliminate binding. To prevent the rails from running and binding at the joints with the live rails, the full rail past the live rail joint can be anchored with patented anchors and additional strap anchors bolted to the ties and the concrete approach aprons.

Salt or chemicals causing rust should not be used to melt snow or ice from scales or scale decks. The scale house should be arranged to protect the scale beam from the weather and also to protect the weighmaster while weighing. It is very important to maintain the beam in a clean condition and to keep the printing device properly adjusted at all times.

Some railroads are installing concrete decks on track scales. They are so designed as to afford good drainage. Concrete scale houses are also being provided by some railroads.

Scale pits should have good drainage and be well ventilated. Means should be adopted to lead water out and away from scale pits with a view of preventing dampness and consequent rusting of the scale.

Good Drainage Necessary

The need for proper drainage requires that the scale be located at an elevation above the surrounding ground so that a falling grade from the pit can be obtained. The floor of the pit should be sloped to drain to a central outlet point, and the walls and floor made impervious to water by constructing them of first class concrete masonry.

In case a falling grade sufficient to drain the pit is not obtainable, a cistern can be provided at a suitable distance from the scale into which the water can drain by gravity and thereafter be pumped out. The small amount of rain falling on a scale platform does little damage except that no moisture should be allowed to enter the pit. A small heater used in the pit will keep the air dry, eliminating moisture and helping to prevent hardening of the lubrication of the bearings, etc.

The provision of drainage for scale pits in most cases entails the common practice of carrying drain tiles to a natural drain, such as a small creek or slough, or, where available, to sewers connected to municipal drainage systems. Provisions should be made to prevent the possibility of water backing up into scale pits through these drainage systems.

In cases where no drainage systems are available, much more care must be taken in waterproofing the scale pit by use of asphalt and cement coatings, both exterior and interior. Also, a sump equipped with an automatic pump should be provided in the pit.

Painting Practices

It is recommended that the steel portion of the scales be painted at regular intervals to prevent too much damage from corrosion. It is generally more economical to repaint before the old paint film is broken to avoid the necessity of extensive cleaning at the time paint is applied. The surfaces should be perfectly dry and cleaned free from all loose paint, scale, and rust before paint or any other type of protective coating is applied.

If the paint is in good condition, cleaning may be done by means of scalers, scrapers and wire brushes. When the condition of the metal is such that the wire brushes and scrapers are inadequate then flame-cleaning or sand-blasting should be done.

Red lead in linseed oil, when covered with a finishing coat of aluminum or iron oxide paint, forms a very durable coating and will protect the steel from corrosion for a long time. Chromate of lead pigment paints also make excellent priming coats. For best results these coats should be covered with two water resisting finishing coats. It has been found that, where aluminum has been used, scale parts are easily kept clean and the pits are better illuminated due to the reflecting quality of this paint.

A Laborious Task

Some railroads have shops where all scales are reconditioned to manufacturer's tolerance, and some have a master scale located at the shop. The ordinary method of repairing scales in a shop is a slow, laborious task, a great deal of which through necessity must be done by hand. In many cases where pivots, loops, or bearings are worn or cut beyond certain limits, they must be replaced.

Many railroads still have a number of old-type scales, both light and heavy capacity, with cast-in pivots and bearings. Scales of this type necessitate a considerable amount of labor to renew such parts and it is on this type of scale, rather than the type with machined-in pivots and bearings, where there is the greatest opportunity for saving by the use of self-hardening metal, although savings to a somewhat lesser degree can be made on scales equipped with machined-in pivots and bearings.

The ordinary method of shop repairing scales is to anneal or soften loops and bearings to a point where they can be filed or otherwise worked back to a smooth even surface, after which they must again be hardened. This, of course, cannot be done indefinitely and after several such operations there is no longer sufficient metal left to carry the load and the parts must be replaced. In case of the pivots, they can sometimes be sharpened, but for the most part at least some of them must be replaced, and this entails not only an expenditure for materials but also a considerable labor cost.

Probably the most expensive operation at the scale shop is the fitting of the pivots into the levers. Obviously when a pivot reaches the point where it must be replaced, all of the labor spent in fitting is lost. The same is true with some types of bearings.

Use of Self-Hardening Metal

One railroad began experimenting with self-hardening metal several years ago in an effort to save the labor of fitting new pivots and bearings as well as the cost of material. The principle involved in the use of self-hardening metal for pivots and bearings is very simple and consists of building up worn knife edges and cut bearings with self-hardening metal and grinding back to the original shape. While the principle is simple, the actual procedure is a job for an expert welder.

After considerable experimenting, it was found that this metal could better be applied by the use of the oxy-acetylene welding method. Difficulty with pivots warping when this metal is applied to the knife edge has been overcome by preheating the entire pivot or bearing. This serves a two-fold purpose: it prevents warping and toughens the pivot to a point where it will not break even though the knife edge is still extremely hard. The same method may be employed with bearings.

While this is a comparatively simple method of shop repairing scales, it is one that must be applied in a well-equipped scale shop and cannot be successfully done in the field, for the levers still require very careful calibration and sealing and the loops and bearings must be surfaced on an accurate machine. The practice of using self-hardening metal for pivots and bearings is one that is likely to be abused if attempted in the field and its use should be confined to the shop.

Scale houses should be kept painted and surrounding premises kept clean and free of weeds. These houses should be kept clean and free of paper and old scale tickets.

Where compressed air lines can be extended to scales an easy and convenient method is provided for keeping decks, scale bridges, and lever systems clean. Where air is available, section men may be assigned to keep the decks clean, and B&B forces may use the air to clean the scale mechanism.

In applying movable wood decking, it is considered good practice to allow a clearance of at least $\frac{3}{4}$ in. between the wood and the dead rail, or dead rail stands, and end foundations. This clearance opening may be covered by the application of $2\frac{1}{2}$-in. fire hose, which has been split to a single thickness. The hose is fastened to the line deck only, the loose side being allowed to lie on the dead rail in such way as to cover the base of the rail up to within $\frac{1}{2}$ in. of the web. On ends, the practice is to allow approximately 3 in. of the fire hose covering to lie on end walls, being fastened in any way except to the line deck.

Protection of Decking

One method of protecting rigid wood or steel decks from dirt accumulation is to place shields made of metal sheets about 6 in. wide over the floorbeams, keeping them clear of the web of the live rail.

Another method is the application of 2-in. by 2-in. angles to the rigid deck in such way as to allow a clearance of $1\frac{1}{2}$ in. between the angle and the dead rail, after which a $\frac{3}{16}$-in. by 6-in. by 8-ft. steel plate with enough pieces to equal the length of the live rail is hinged to the angle, with stops applied to the angle so that this cover does not touch the web of the live rail.

A third method is to install separate covers around each live rail pedestal. A 1-in. angle is applied to the deck around the pedestal, plus a pan made of $\frac{1}{8}$-in. steel flanged in such way that the flanges can be turned down under the rail and fastened with rail-clip bolts to the pedestal, with a clearance of 1 in. of pan flange outside of the angle which is fastened to the deck.

Where the design permits, waterproofing of decks with an asphalt coating generally pays dividends in the form of savings in scale maintenance. Sealing out of water and moisture from scale pits prolongs the life of the structural steel and of pivots and bearings of the scale mechanism, therefore prolonging life expectancy of the scale proper and permitting more accurate weights being maintained with less maintenance of the scale mechanism. Where steel deck plates are used and the joints only are sealed against moisture, the use of an emulsified asphalt coating, similar to the undercoating used for automotive equipment, will greatly reduce the amount of condensation and resulting moisture drip over scale mechanism during extreme temperature changes. In general, waterproofing maintenance costs are offset by savings in scale overhaul and maintenance.

Monthly inspections should be made by a competent inspector to test the scale as well as to correct any irregularities about the house or premises. Any faulty condition found should be corrected at once. Correctness of the track scale has a direct bearing on railroad revenue and careful and efficient maintenance is most important.

Running repairs necessary on track scales can be made satisfactorily by trained scale inspectors supervising the work with the assistance of bridge and building forces. However, where major overhaul of lever systems is concerned, this work should not be attempted by untrained forces of any department of the railroad but should be done in a properly equipped scale shop. Where there are sufficient scales to warrant a scale shop with trained personnel to properly overhaul and seal out levers and weigh-beams, this method of scale maintenance should be considered.

Where there are not enough scales to warrant the establishment of a scale shop, it is recommended that overhauling of lever systems be done by reputable outside scale shops, with frequent checks being made by the supervisor of scales during overhaul of scale parts.

President Martin began the discussion by saying that track scales have the same function as scales in a butchershop—they both determine the amount of revenue to be received—hence should be kept in good condition. J. A. Jorlett (PRR) asked about the self-hardening metal mentioned in the report, and Chairman Laird explained that this metal was applied to the pivots by welding and saves time that would be required for removing the pivots and repairing them by forging.

There were several comments on the subject of keeping scale pits dry, some men advocating heaters for this purpose, while others said that heaters only caused moisture to condense on critical scale parts. One member said that heaters with circulating air was helpful; another that a hot-water heating system and circulating air had served him well; while another thought that dehydrating chemicals were the answer.

Safety Problems of the Supervisor

Report of Committee

COMMITTEE—G. SWITZER, Chairman, asst. div. engr., W.P., Sacramento, Cal.; H. D. CURIE, *Vice-Chairman,* mast. carp., B.& O., Garrett, Ind.; J. J. HEALY, *Vice-Chairman,* b.& b. supr., B.& M., Boston, Mass.; E. H. BLEWER, asst. supt. safety, N.Y.C., New York, N.Y.; G. S. CRITES, div. engr. (retired), B.& O., Baltimore, Md.; P. H. CROFT, asst. engr. m. of w., I.C., Memphis, Tenn.; R. L. FOX, div. engr., Sou., Alexandria, Va.; L. C. GILBERT, sen. engr., E.J.&E., Joliet, Ill.; A. M. GLANDER, ch. carp., C.M.St.P.& P., Mason City, Iowa; F. F. HORNIG, div. engr., C.M.St.P.& P., Mason City, Iowa; H. C. LITTLE, supv. w. s., I.C., Vicksburg, Miss.; L. MAYFIELD, res. engr., M.P., Houston, Tex.; W. R. MEEKS, b.& b. supv., M.P., Falls City, Neb.; R. F. REESE, b.& b. supv., T.& N.O., Houston, Tex.; P. E. SCITES, supv. b.& b., C.& O., Huntington, W. Va.; S. WHITE, b.& b. supv., S.P., Tucson, Ariz.

The problems of a supervisor are numerous, but one of his most important duties is safety. Is it possible to perfect a safe working organization? We have heard the expression of a famous industrialist quoted many times: "The extraordinary we do now; the impossible takes a little longer!" This seems to sum up the safety problems of most of the B&B supervisors of the American railroads in attempting to attain a perfect yearly accident record. This goal has been attained by many supervisors; so there is no good reason why it is not attainable by all who seek safety for their personnel.

The main problem of the supervisor is that his everyday work requires increased production without sacrificing safety. There is no other sub-department in the maintenance-of-way department where a supervisor is required to be conversant with so many different categories of construction work. His gangs travel by motor car or truck to various locations on a division. They use cranes, tunnel jumboes, compressors, power saws, concrete mixers, jackhammers and vibrators in the tunnel gangs. The building construction gangs work from concrete foundations up to roofs—with all of the various phases of construction involved. The bridge and painting gangs must go out on scaffolds and catwalks and climb trusses and girders. Each phase of the work offers a different type of safety problem, which must be coped with before the men can produce safely.

We find that safety has been a subject for committee reports for several years in both the Roadmasters' and B&B Associations, and through these committees we find that accidents on the American railroads have declined steadily for the past several years as a result of the supervisors' continual program of education and advertising, to attain better safety records.

The supervisor must first believe in his management's program of production with safety; and unless he does, this committee is certain that he cannot "sell" safety to his foremen. If there are any flaws in the program, you can be certain that management will be the first to take the necessary steps to correct them, to assure the supervisor that all his efforts to reduce accidents, attain a perfect safety record, and keep production at a high level are not in vain; because production without safety is something that no railroad wants, and none can easily afford.

Safety is not the job of the director of safety nor of the supervisor alone. It requires the cooperation of every man on the job. The supervisor must sell safety to the men he supervises. In order to do this he must have the confidence of his foremen and workmen, and must be sincere in his personal actions, and convincing in his discussion of safety. He must have an attitude that will put his workmen at ease without sacrificing discipline; so that the men are able to think in the right direction. Safe habits cannot be successfully developed in men by a process of continuous rebukes and criticism.

The supervisor must have a thorough knowledge of safety and practice safety at all times. He must have sincere belief in his safety program before he can teach or promote or encourage safety. He must be interested in the general welfare of his men and not just teach safety because he has been instructed to do so. It is mandatory that he have enthusiasm, sincerity and emotional stability, a combination that cannot be obtained without first having a real desire to help his fellow men.

The committee reports that men working under very dangerous conditions, such as around derailments and washouts, in tunnels following failures, etc., are less apt to get hurt than those who are doing more or less routine work. Men who are close to danger are more on the alert and are more constantly on guard than men who are working where there is little apparent danger, as these allow their minds to stray from the work at hand.

The transportation of men and material by motor car is of major importance, and, if not properly policed, is one of the most difficult safety problems with which the supervisor has to contend. Proper training and obedience to rules governing motorcar operation are the answers to this problem.

Supervisors should see that motor cars are operated by qualified men who are familiar with the rules and territory to be covered. The motorcar operator should not be allowed to transport men or material until he has demonstrated to his supervisor's satisfaction that he understands the rules of operation and the reasons for them. A lineup of all trains should be secured and read to all of the men before the car is placed on the track. The lineup should be regarded as information only and does not relieve the operator of the responsibility of protecting the car.

Many accidents have occurred due to the failure to observe the rules governing the speed of cars. This is particularly true at road crossings. Motor-car rules require a speed over crossings that would permit a car to be stopped short of a collision with a highway vehicle. However, we continue to read reports of such accidents. Such cases deserve no leniency because, if the operator had obeyed the safety rules, he could have stopped and allowed the highway vehicle to proceed. There is no record of a highway vehicle backing up and striking a motor car!

Why should a foreman attempt to beat a highway vehicle across a road crossing? On short time and late getting in to his outfit for lunch or at the close of the day? Attempting to get in before the assigned hours are up? He may be attempting to get to a siding in advance of an approaching train—no crew wants to lift a heavy motor car to safety.

There are numerous reasons for such an action, but would a well-trained foreman jeopardize his men's safety for any of the above reasons? The chances that he would are remote; because if he had been well trained, he would have planned his work so that such conditions could not have materialized; and that brings us to the next safety problem of the supervisor; the training of new men.

It is the supervisor's responsibility to educate his foremen to perform their duties and progress in their work according to the production schedule; and to educate them to do it safely so that the foreman can teach his men so that they remember. An example of this method is the "Safety Rule of the Day" program used extensively by many railroads.

Training should begin by getting the men ready to learn and the supervisor ready to instruct. Care and patience should be exercised in training new foremen because the welfare of the gang depends upon them. There is no substitute for a well-planned program for training both the foremen and his men. Part of the supervisor's job is to be on the alert for men capable of assuming foremen's duties.

Must Have Understanding

The foreman must know and understand the individual workmen under him; and there is no substitute for this understanding on the part of the man who is responsible for the safe completion of the every-day job. He knows the individuals' habits of work, he understands their temperaments, their working capacity, their sense of cooperation, and their reaction to authority. He knows the condition of their health and has a fair knowledge of their future hopes and ambitions. He also has the problem of the employees in the B&B crews, who are 65 years of age or over, and who for financial reasons are unable or unwilling to retire from active service. Because of their age these men are not as capable physically or mentally as the younger members of the crew; and because of these conditions, the foreman must be eternally vigilant in his observation of these employees to prevent accidents to themselves or other members of the crew.

Experienced employees should be urged to assist in educating and assisting new employees in learning their work and the safe way to do it. This assists the foreman in training his men, allowing him to devote more time to the individual and, in turn, giving the supervisor additional time to observe potential foreman material and to begin training of the men who appear to be in line for advancement so that, when an opening appears, he has available to fill the vacancy men who can be depended upon to handle the job and personnel both efficiently and safely. The supervisor's time is limited and this is one method in which he can accomplish an important phase of his job within his time limit.

Training instructions should also be safety instructions. Instruct, demonstrate, correct, and instruct again in the safe way, and indifference to doing the job safely will not develop. If a man learns to do the job in an unsafe way, the unsafe method is impressed upon his mind. His unsafe method becomes a habit and exposes him to danger every time he performs the operation. If, after repeated instructions and training, an employee refuses to work safely and demonstrates that he cannot or will not do the job as he was instructed, or if he is repeatedly involved in accidents due to his carelessness, he should be removed from service. It is better for him to be off the job than to cause serious injury not only to himself but to his fellow employees.

Accident investigation is an important job in itself if the foreman and his gang are to profit from past mistakes. The supervisor should investigate all accidents and injuries promptly to determine the cause, and should carefully explain to those involved, as well as all others in the department, what should have been done to prevent the accident or injury. While the accident is still fresh in the minds of those concerned, the supervisor should start collecting and sifting facts. Labor representatives should be encouraged to cooperate with the supervisor in investigating accidents to determine the reason for an employee's accident or injury so that it can be discussed at the organization's meetings and further the cause of safety by bringing it to the members' attention from the standpoint of his fellow workers. It should be impressed on all concerned that the safety rules were created as the result of accidents that could have been prevented had the rule been observed at the time of the accident. An accident usually means that there is an unsafe condition or an unsafe practice and corrections to prevent its recurrence should be made immediately.

The supervisor should never disregard the non-reportable accident just because it will not appear on his safety record. The non-reportable accident or the "near miss" does not always cause injury, but it does serve warning of expected trouble ahead. What keeps a near accident from being a really serious accident? Luck, or someone's fast reflexes; but conditions that almost caused an accident can just as easily be the cause of a real accident next time. The falling timber that missed your foot this time, when you weren't wearing your safety shoes, might have crushed your foot. The welding sparks that missed your eyes this time when you had forgotten to wear your safety goggles may make a bull's eye next time—and then you have lost an eye. There is only one sure way to get the men to wear the proper clothes and use safety appliances and that is to have the foreman also wear or use them. This again brings in the supervisor and his ability to sell the foreman and workmen on the idea.

Statistics have proven that non-reportable accidents out-number reportable accidents. Ignoring the conditions that cause these near accidents is a sure invitation for a real accident.

So everyone should keep his eyes open for the little things that go wrong—correct them or report them; don't shrug them off. Treat every accident as a bad accident and unearth the causes. Supervisors should be able to detect unsafe acts and rule violations that could lead to serious consequences. Supervisors should also follow up minor injuries to see that employees receive proper attention thus avoiding reportable injuries and lost time due to infection or improper care.

Conducting Safety Meetings

Safety meetings are another responsibility of the supervisor. Mass safety meetings have their place, but their greatest drawback is that the men on the gangs seldom get a chance to engage in discussion. They may also involve problems that are not common to the experience of the B&B department and, therefore, the men soon lose interest. Group safety meetings held by the B&B supervisor with the help of the division engineer and safety engineer should discuss accident causes familiar to the men. Discuss the tools they use, the materials they actually handle, the machines that are involved in their everyday work. Talk to them about their work methods and "housekeeping" habits around the job. Poor "housekeeping" has been the cause of many serious accidents.

The safety meeting talks should not be lectures. They should be discussions — the aim being to induce the men to talk things over with the supervisor. It is one way of getting cooperation — when safety becomes their problem, too. Safety films, safety graphs, instruction booklets and cards can be procured from your safety department as part of your program. Demonstrations of improved tools, work methods and first-aid technique is also helpful. It takes skill to have everyone participate in a safety meeting, but the supervisor can learn to do it as well as teach his men to participate.

It should become the practice at safety meetings to encourage *all* attending to enter into the discussions. Safety talks should challenge the men's ability to think and encourage the men to make the meetings their own, the problems their own and the solutions their own. Never "brush off" a suggestion from the men; give it a chance to be discussed. Such discussions have sometimes brought out the fact that the men were not clear on the interpretation of rules and were anxious to obtain further information.

The committee has found that informal, short and cheerful meetings held by the supervisors as frequently as possible have been very successful. Some roads try to carry out these meetings weekly, others monthly, at which time the supervisor talks to the gangs on the job regarding their safety problems, following which a brief report stating what was discussed is furnished to all personnel involved. While safety is the main topic, all are encouraged to discuss any phases of their work, and where the organization representatives have been encouraged to take part in the safety programs, the results have gone far toward increasing the morale and goodwill of the men.

The impossible can be attained! Aim high, strive for it, live for it, dream it, pray for it, fight for it and there is nothing that can stop you from attaining it.

Discussion

G. S. Crites (B&O, ret.) told of an incident where a section gang loaded a crossing sign onto a push car, then pushed the car along the track ahead of the motor car. The sign fell off, derailing the car and injuring a man who was riding on the push car. Push cars should not be placed ahead of motor cars, he said.

W. A. Huckstep (MP) reported that he had two accidents among his men who were using soda-acid extinguishers. In one case, the extinguisher was to be recharged and was turned down for discharging onto the ground. When nothing happened, the extinguisher was uprighted to see what was wrong; and the charge went off in the face of the man doing the recharging. Men doing recharging work should be properly instructed in this operation, he said. In the other case, a soda-acid extinguisher had been used to put out a small fire and a man was assigned to clean up the mess. He used a hose to flush out the place, causing an explosion.

J. N. Burkel (MP) told of a steel gang that had several avoidable accidents, so the foreman was given a good "dressing down." The foreman then blurted out that everything seemed to be going wrong lately, first his family troubles and now these accidents. This demonstrates, Mr. Burkel said, how distractions will prevent a person from having a clear mind on the job.

Developments in Power Tools and Machines

Report of Committee

COMMITTEE—J. T. HINER, *Chairman*, b.& b. supv., Sou., Greenville, S.C.; J. M. GILES, *Vice-Chairman*, asst. engr., M.P., St. Louis, Mo.; W. W. GAINES, *Vice-Chairman*, supv. b.& b., C.& O., Huntington, W.Va.; E. H. BARNHART, div. engr., B.& O., Garrett, Ind.; M. D. CAROTHERS, asst. ch. engr., G.M.& O., Bloomington, Ill.; M. H. DICK, editor, Ry. Track & Structures, Chicago, Ill.; P. KNAPP, mast. carp., Erie, Jersey City, N.J.; W. G. MATEER, mgr., p.& s., E.J.& E., Chicago, Ill.; G. J. MORRIS, supv. service, Elec. Tamper & Equip. Co., Cambridge, Ohio; V. D. RAESSLER, supv. b.& b., I.C., Memphis, Tenn.; A. W. SCHROEDER, supt., C.& E.I., Danville, Ill.

The use of power tools and machines on railroads has assumed large proportions. Increased labor costs make it imperative that the bridge and building supervisor make all possible use of such equipment in order to increase man-hour output and decrease costs. It is necessary that the supervisor keep abreast of the times on all new developments.

With the ever-increasing use of power tools and machines and new developments it is of interest to the association to keep its membership informed of new power tools and new developments in existing power tools.

High-Cycle Generators, Tools

Recently made available and finding approval on various railroads are several dual-purpose high-cycle generators. They provide 230-volt 180-cycle 3-phase alternating current to operate high-cycle electric tools, and also direct current for the operation of standard universal tools. These generators are highly portable, the 5000-watt capacity generator weighing only 175 lb. These generators make it possible to make a gradual transition from standard universal electric hand tools to those of the high-cycle type.

Coming into more use all the time are high-cycle electric tools. These tools operate on 220-volt 3-phase 180-cycle current. They are more powerful than the standard universal 60-cycle alternating-current tools and they maintain practically constant speed at all loads. They are available for drilling, reaming, screw driving, nut running, tapping, grinding, sawing, paving breaking, and vibrating concrete.

There is a high-cycle electric chain saw that is finding use on railroads. The 24-in. saw weighs 33 lb. and can be operated by one or two men. The saw is claimed to be easier on the operator and to have a low maintenance cost due to the simple high-cycle electric drive.

A powerful 2½-hp. general-purpose vibrator for operation from light socket or power plant is on the market. It can be used with any length of shaft up to 28 ft. Its rate of vibration is from 8,000 to 10,000 per minute, depending on the consistency of the concrete mix and the length of shaft. It has three sizes of vibrator heads and can be quickly converted to drilling, driving or wet grinding.

There is now available an electric vibratory compactor that operates on a 120-volt, 3-phase, 60-cycle a.-c. generator. It develops up to 4500—1¾-ton blows per minute. The operator guides it over the work. It is claimed that it can compact an area of 900 to 1200 sq. ft. per hour and that it can be used to compact crushed rock, hot and cold asphalt, and granular soils. It is suitable for use in building station platforms and street crossings and concrete sub-bases where heavy weight is to be placed on floors. The compactor has been used to compact sand sub-bases 18 to 36 in. thick, and found to work very successfully for this purpose. The compactor can be made completely portable. It is possible for one man and a vehicle to transport and operate this compactor.

Tractor Compressors

There are available today several new, portable air compressors combined with tractors mounted on pneumatic tires and with transmissions. The tractor in these units, in addition to serving as a carrier for the air compressor, can be utilized for tractive purposes. Auxiliary attachments convert this compressor to special uses. There is a plow for snow clearing, front-end loader, front and rear winches, backfill blade for filling small excavations and a post-hole auger. Pneumatic rear mountings include medium and heavy-duty rock drills, concrete breakers and backfill tampers. This piece of equipment has found favorable acceptance on many railroads and has proved to be a very versatile piece of equipment.

An air compressor of 125 c.f.m. is available for truck mounting and truck-engine drive. The unit mounts on many popular makes of trucks and derives its power from the truck engine through a simple power take-off. First costs are lower for this type of compressor and maintenance cost is less since there is no separate compressor engine to maintain. The compressor is claimed to be capable of driving two heavy-duty or three medium-duty paving breakers. During the compressing operation the truck-engine speed is automatically regulated for idling and compressing. The compressor takes up a small portion of the truck body.

Improvements have been made in sand blasting for removing old paint, dirt and rust prior to painting metal bridges. There is now available a wet sand-blast generator using a mixture of sand and water. One user states that wet-sand blasting is superior to dry-sand blasting in that it allows the use of a corrosion-inhibiting solution, cleans many surfaces faster, eliminates damage to adjacent machinery and equipment, and eliminates the expense of drying sand.

Precision Power Saw

A pneumatic precision power saw, which is said to be as accurate and easy to handle as a hand saw but many times faster, is now available. Weighing 14 lb. the saw is operated by any compressor with a capacity of 60 c.f.m. or more. The saw's twin reciprocating 21-in. blades operate through a 4-in. stroke at the rate of 15,000 strokes a minute. The opposed motion of the blades provides balance to the extent that thrust or torque during sawing, or "kick" on completion of a cut, is eliminated. The saw has proved to be equally effective for cross cutting, ripping, and notching. Width of cut it limited only by the length of the blade, and the depth of cut is unlimited. The saw teeth can be resharpened the same as any hand saw. One railroad states that this saw can be operated by one man and work in tighter places than the ordinary chain saw. Other railroads give favorable reports on the saw.

Portable air hoists are being used for varied purposes in maintenance work. Excellent results have been reported in their use at roundhouses, on bridge gangs, and in fact all places where lifts are needed.

There are numerous types of air scalers being used by different railroads. The valveless scaler has a rapid vibrator action which effectively removes old paint, rust and scales without damaging the metal surface. With these scalers certain care has to be taken so as not to damage metal surfaces.

There is available, and known to be used by one railroad, a horizontal earth auger that is manufactured in sizes ranging from 3 in. to 36 in. It is said to be capable of drilling up to distances of 100 ft. with a normal rate of 1 to 2 ft. per minute. It can be operated by either air or electric motors. Normally the drill is worked through a casing. As the drill advances the casing is either jacked or pulled in so that a guarded hole is maintained at all times. When the other side is reached the job is completed by extraction of the drill. The unit is essentially an earth auger and not a rock drill. However, it will chew through such matter as old stumps, some shale formations and small rocks. The drill has been used for installing corrugated iron pipe.

Power Hand Tools

Many small powered hand tools are being used more and more by water service men, mechanics, and other forces with satisfactory results. A few of these tools are as follows:

(1) An electric impact tool in sizes up to ⅜ in. for drilling and ⅝ in. for nut running.

(2) Rotating electric hammers and air hammers for drilling masonry.

(3) Pistols for exploding cartridges for driving studs into concrete, steel, brick masonry and wood.

There are several lightweight gasoline-engine driven pumps available that are capable of pumping up to 15,000 gal. per hour and weigh less than 100 lb. These pumps are such that it is possible for one man to transport and operate one of them.

There are available concrete pumps that will transport concrete from the mixing plant through a pipe line to the site of placing. These pumps are capable of pumping up to 120 ft. vertically and 1000-ft. horizontally, with rated capacities of from 15 to 65 cu. yd. per hour. They are advantageous where a large volume of concrete is to be placed and it is impractical to have the mixing plant near the site. With this pump it is possible to eliminate much road building, trestling and scaffolding, and in some instances cranes and buckets.

Some railroads have changed their coal-fired steam boilers on pile drivers to the oil-fired generators similar to those used to heat diesel passenger trains. The generator, burning atomized diesel oil, develops full working steam pressure in a few minutes from a cold start and can be blown down in a few minutes and left to stand in cold weather. Once started, automatic controls take over and turn the machine on and off, maintaining the determined steam pressure. Water being pumped into the generator is continually turned into steam; therefore, it is not necessary to shut down when feedwater is added. These steam generators are available in various sizes developing from 360 to over 14,000 lb. of steam an hour with steam pressure from 75 to 600 lb. per sq. in. Several pile drivers on railroads have been converted and are performing routine pile-driving duties. With this type of pile driver standby watchman service is eliminated.

A practically self-contained pile hammer has been developed to fit a 20½-in. lead for handling by one line. The hammer operates on diesel oil from a tank mounted on the hammer. This hammer is made in several sizes up to one developing 84 blows of 16,000 ft. lb. per minute. The hammer may be used for driving steel, sheet, timber and concrete-type piles. This type of hammer will adapt a crane to pile driving.

More Trucks in Use

Trucks are becoming almost a "must" for bridge and building forces. Trucks and the use of highways can add many valuable working hours to the actual working time of a gang. Trucks can be used to transport men, materials, tools and equipment from headquarters or camp cars to the job site. With adaptations they are a versatile piece of equipment. Some railroads are equipping them with dump hoists and are realizing savings in the cost of hauling sand, gravel, lumber and other materials. There is a dump hoist available that will convert cargo-type beds to dump beds. Some trucks have been provided with small cranes that take up a small portion of the bed space. These truck cranes are capable of handling pipe, structural steel, forms, concrete and many other materials. Winches on trucks are proving advantageous in loading, unloading and handling certain materials and equipment.

Cranes for excavating and material handling mounted on rubber ties are being seen in increasing numbers doing all types of maintenance work on railroads. They have high maneuverability around the right-of-way and can be moved rapidly from job to job, some at regular truck speeds. The material-handling capacity usually varies from ¼ to ¾ cu. yd. with lifting capacity up to 35 tons and possibly higher. On some models a single engine provides power for propelling and operating the unit, while other models have two separate engines. Many bridge supervisors have found these cranes advantageous in handling bridge material, excavating for abutments and driving pier piles, handling bridge steel, cleaning up slides, setting poles, and razing buildings. One particular advantage of this type crane is that a work train can often be eliminated where it is necessary to use a crane.

The above is not a complete list of developments in power tools and machines. Manufacturers are continually making new equipment and improvements in existing equipment. If the bridge and building supervisor will keep abreast of new developments of power tools and machines he will find equipment that will not only speed up his work but will oftentimes show substantial labor savings. However, this equipment can represent a large investment. Careful judgment must be used in adopting new equipment and developments.

E. R. Schlaf (IC) asked what type of an inhibitor was used in the wet-sand blasting operations and, when F. R. Spofford (B&M) explained it was a chromate. Mr. Schlaf said that dry chromates have a toxic dust, so care should be exercised in their use.

Several members commented favorably on the use of the pneumatic precision power saw with the reciprocating blade, saying it could be used in places that are ordinarily inaccessible and that it does not chew up the guide planks.

R. C. Cox (WP) stated that for three months his road has been using a pile driver equipped with a steam generator and that it has given fine service. W. A. Huckstep (MP) asked if spare generator parts are carried along, and Mr. Cox said that this was not necessary as it is the same type of generator that is used on their diesel trains. He added that the generator has been used for melting snow in turntable pits. Lee Mayfield (MP) asked if the water used in these machines must be demineralized, but Mr. Cox said he has been using the same water that is supplied to their steam locomotives.

How to Make Durable Concrete

An Address

G. H. Paris, Railroad Representative, Structural &
Railways Bureau, Portland Cement Association,
Chicago

Railroads have used concrete for over 50 years in more ways possibly than any other single industry. Its use generally has been predicated on sound engineering principles as evidenced by the hundreds of structures still in use today after many years service. Some structures, however, have required maintenance for one reason or another and this has focused attention on the art of making durable concrete.

Three important qualities are generally required in most concrete. These are durability, strength and watertightness. Each is related to the other and all three depend upon the same well-established basic principles for their performance. These principles include the use of sound aggregates, good proportions, proper mixing and placing and adequate curing. Another principle—air entrainment—has been added in recent years for concrete exposed to weathering, especially freezing and thawing. Thus, durability as well as strength and watertightness must be built into the concrete during its manufacture by applying the basic principles. Once the concrete is made none of these qualities can be changed.

Field and laboratory studies by many different organizations, including the Association of American Railroads, have shown that aside from weathering, neglect of one or more of the basic principles of making quality concrete is most frequently responsible for concrete deterioration. This includes the use of too much mixing water, poor materials, insufficient curing and poor workmanship. Yet all of these factors can be properly controlled in the field at little or no extra cost. Occasionally even concrete made with careful control develops trouble because of some factor such as sulphate water, chemical attack or improper construction practices not directly covered by the basic principles.

Fortunately, however, concrete is not a delicate material and it will withstand considerable misuse and abuse during its manufacture and still perform satisfactorily. However, the objective on the railroads is to produce durable concrete consistently and economically. To do this all of the basic principles must be applied all of the time. There are no short cuts.

The methods of manufacture may limit the service life of the concrete. One should not expect concrete made with little or no control to last as long or perform as well as concrete made with careful control. At best the results will be haphazard, some jobs may be good, others are certain to be bad. More cooperation is needed between the field and office forces to assure the necessary control. Construction practices used on many roads do not provide the field control over the manufacture of the concrete that is assumed in the specifications. Yet the quality of concrete is believed to be that which would be obtained if the specifications were followed to the letter. Such wishful thinking will not produce quality concrete. The basic principles must be followed in all respects.

Real skill and experience is needed to apply the basic principles in the field. Too often in the search for a practical or a more economical way to make concrete, one or more of the basic principles is ignored or compromised, with the result that the durability and other qualities of the concrete are impaired. Practical methods are not substitutes for fundamentals, but are the best way of applying those fundamentals.

Much of the defective concrete made today is a victim of speed in our hurry to get jobs done more quickly. Trying to make speed records for any reason encourages the use of overwet mixes, placing the concrete continuously in lifts that are too high, inadequate and non-systematic vibration and working of the concrete into place, and a tendency to dump the concrete into the forms at only a few points instead of distributing it more uniformly. When speed is given priority the mixer is run at or above its rated capacity and the construction crew is generally required to keep up with the mixer regardless of whether the crew is adequately manned with men having the experience for the job. Thus, although the crew may be doing its best to carry out the provisions of the specifications, they are frequently unable to perform all the details that are necessary to produce uniformly good results.

While much of the defective concrete that is made can be attributed to the use of improper construction practices, this is not always the case. In some instances other factors, such as poor materials, may be responsible. Occasionally unsound cements have been used because they were not tested, but more often poor aggregates have been the source of trouble. Too often aggregates are assumed to be all right. Unless it is known from previous experience that the aggregates to be used are sound, they should be tested. Even aggregates from the same source may vary considerably in quality from time to time and should be tested periodically. Many roads have their own testing laboratories which can be used for this purpose. Since aggregates constitute about three-fourths of the volume of concrete it is important that the aggregates be of good quality.

Aggregates should be properly graded for reasons of economy and workability. The better the aggregate is graded the less cement paste required for a given workability. This fact can be demonstrated very simply. Here are three jars filled with aggregate. The first jar contains a coarse aggregate in which all the particles are the same size. The next jar contains a well-graded coarse aggregate, while the last jar contains both well-graded coarse and fine aggregates. Now let's suppose that the liquid in these containers is cement paste and see what happens when it is poured into the jars of aggregate. The first jar containing all coarse aggregate of one size requires nearly all of the liquid to cover the material. The next jar filled with well-graded coarse aggregate takes less liquid, while the last jar containing both well graded fine and coarse aggregates requires the least amount of liquid. Thus, the better graded material requires less cement paste to fill the voids and consequently less cement per cubic yard of concrete. Furthermore, concrete made with well graded aggregates will have better workability with less tendency to segregate.

Another way to produce economical concrete is to use the largest size coarse aggregates possible since less paste is required to coat them and fill the voids. This can be demonstrated quite readily with an orange. The outside of the orange is entirely covered with peel. Now, if the orange is cut in half and then in sections there no longer is enough peel to cover all of the individual surfaces. Similarly, the larger the top size aggregate that is used the less paste required to cover it and consequently less cement.

Probably the most abused practice in making quality concrete is the use of too much mixing water. When the concrete is too stiff to place or finish, when it doesn't run out of the mixer fast enough or flow around the corner of the forms, the familiar cry goes up — more water. Did you ever stop to think what happens when more water is added? Do you know that the workability of concrete can be changed without changing the water content.

First of all, the water-cement ratio law states that the quality of concrete depends upon the amount of water used with each sack of cement. This is a fact that has been proved many times in the laboratory and time-tested in thousands of field structures. The law has been known for over 30 years. In effect it means that once the amount of water required to produce concrete of the desired quality is determined, the water content should not be changed under any circumstances. If more water is added then the quality of the concrete is changed.

The slump or workability of concrete can be adjusted very easily by changing the proportions of aggregate used in the mix without changing the amount of water added to it. Some people have the idea that concrete made according to the water-cement ratio means stiff, hard-to-work concrete. This is not true at all. The water-cement ratio means simply that the amount of mixing water used with each sack of cement governs the quality of the concrete.

One of the first steps in making quality concrete is to determine the maximum amount of mixing water that can be used with each sack of cement. This usually depends upon exposure conditions and will generally vary from about five to six gallons of water per sack of cement. This means all of the water, including that in the aggregates.

Just as an example that concrete made according to the water-cement ratio need not be unworkable, I would like to demonstrate how the consistency can be made whatever is desired. To begin, let's visualize that concrete consists of a paste or glue composed of cement and water that sticks or holds the aggregate together. Now let's assume a water-cement ratio of 5 gallons of water per sack of cement and mix the water and cement together to form a paste. Only about 3 gallons of water are required to hydrate the cement.

The rest of the water is simply used to make the concrete workable. Actually the paste could be used without any aggregates, but it would make pretty expensive concrete. So let's add some sand and gravel. If we stopped now the mix would be pretty sloppy and expensive, but we keep on adding aggregates until we have what seems like a reasonable slump for the job. Perhaps it is a thin reinforced wall and we need about a 6-inch slump to place the concrete satisfactorily. Let's make a slump test and see just what we have. How does this look to you?

Now, suppose that on this same job we have some footings and a slab on the ground to construct. A 2-or 3-inch slump is suitable for this purpose so let's take the same concrete and add a little more sand and gravel to it until we have what looks to be about a 3-inch slump. How's that? Just about what we wanted, isn't it? You noticed that the water content was not changed and yet on one hand we had a 6-inch slump and on the other hand a 3-inch slump. The quality of the concrete in each case would be essentially the same because we have maintained the same water-cement ratio all of the time. The only difference between the two mixes is that the 3-inch slump concrete is slightly more economical because more aggregate is used with the same amount of paste. A point to remember then, is that for the same water-cement ratio stiff mixes are more economical in materials. However, mixes must be used that can be readily placed depending upon job conditions to obtain maximum economy of labor and materials.

Another source of error frequently occurs in batching materials. Many roads still batch materials by volume instead of by weight. If bulking of the sand is not considered in measuring the material by volume considerable error may be introduced. Dry sand will bulk as much as 30 per cent or more when a little water is added. Unless this bulking is considered when the sand is batched the mix will be undersanded and consequently, harsh and hard to work. Batching materials by weight minimizes the possible errors.

As an example, here is a bottle filled with dry sand. Let's weigh the sand. Now let's wet the sand with a little water and remeasure it. Incidentally, the amount of water used to wet the sand is about 5 per cent by weight. About this amount of moisture produces maximum bulking and represents the condition of sand frequently found in the field.

Now let's weigh out the same amount of sand that was used to begin with and you can see there is a little left over. That's just about 5 per cent. Now let's fill the bottle to the top and see what happens. Considerable more sand is left and yet all the sand fits into the bottle in the beginning. This is due to bulking or swelling of the sand when it becomes wet. This demonstrates that the amount of error in measuring materials is much less when they are batched by weight instead of by volume if bulking is not taken into account.

Proper mixing and placing are just as important in the production of quality concrete as the use of good materials in the proper proportions. Segregation of the ingredients is a potential trouble-maker that should be avoided in handling and placing concrete. Frequent causes of segregation are allowing fresh concrete to drop too far, especially where there are reinforcing bars, chuting the concrete at too steep an angle and discharging it against the sides of forms or other objects. Concrete should be deposited as near its final position as possible. It should not be placed in one or two places and then pushed around in the forms.

Concrete should be placed at the rate of about 2 feet per hour. Concrete in the tops of wing walls should be stiffer than the concrete below to absorb any water that might have risen to the surface, and thus minimize the effects of bleeding. Wall forms should be overfilled an inch or two and the concrete allowed to settle for an hour before it is struck off to the proper level. Top surfaces should not be overworked as this tends to bring water and fine material to the top producing surfaces that may craze, dust and have poor resistance to weathering. There are many other details in handling and placing concrete that will also help insure its quality.

Curing is probably neglected more than any other one basic principle. Yet proper curing does more to build up the potential quality of concrete at less cost and effort than any other single step in its production. The primary purpose of curing is to keep the moisture in the concrete during its early age. This permits the cement and water to react longer and thus produce a better hydrated cement paste and, consequently, a better concrete. This is just as true of concrete placed in cold weather as it is in hot weather.

During warm weather steps should be taken to prevent the fresh concrete from drying out too rapidly. Many methods of curing are available, but continuous moist curing is preferable whenever it is possible. Other methods of curing include coverings of burlap, cotton or felt mats, sand, hay, straw, sawdust or any other material that will hold moisture and not injure the concrete. Paper and impervious membranes which seal in the moisture are also effective. Regardless of the type of curing used, it should be applied just as soon as possible after the fresh concrete has been placed. Intermittent curing may be worse than no curing at all since it tends to accentuate shrinkage.

Concrete can be placed just as satisfactorily in the winter as it can in the summer if it is protected properly. Concrete can be placed satisfactorily in moderately cold weather, that is, near freezing, by heating only the mixing water. While in extremely cold weather both the mixing water and aggregates can be heated. Concrete temperature at time of placing should be at least 50 deg. F for best results. Concrete can be protected by leaving the forms in place or enclosing the area in canvas and heating the enclosure. Either a high-early-strength cement or calcium chloride can be used to shorten the curing period. It should be remembered that calcium chloride is not to be used as an anti-freeze but rather to give the concrete strength at an early age.

The easiest and most certain way to make durable concrete, that is concrete which will withstand weathering, especially freezing and thawing, is to use air-entrainment. Many people still have not recognized the importance of this basic principle and, consequently, it is sometimes overlooked.

Air entrainment has been studied by many laboratories and organizations and has been used satisfactorily on thousands of jobs. As a result air entrainment has been found to be a fundamental requisite of frost resistant concrete.

What is air-entrained concrete? Very simply, it is concrete into which billions of tiny air bubbles, so small that they can't be seen with the naked eye, have been introduced. These air bubbles serve as protective voids or relief valves, so to speak, during cold weather. When concrete freezes any free moisture in the concrete tends to freeze. As this water expands on freezing it is forced into the many small air bubbles which relieves the pressure on the concrete and prevents cracking. Here are two specimens of concrete cut from pavements. The light colored one is non air-entrained and contains about 1 per cent air. The darker specimen is air-entrained concrete and contains about 5 per cent air. I'll leave these up here so you can examine them later if you care to.

Equally good results can be obtained with an air-entraining portland cement or a normal portland cement with an air-entraining agent added at the mixer. The advantage of using an air-entraining cement is that it eliminates handling an extra material on the job, while the advantage of using an air entraining agent is that it makes it somewhat easier to adjust the air content of the concrete. In either case the usual recommended air content under most conditions is 3 to 6 per cent by volume of the concrete. The air content of the concrete should be checked periodically, at least twice a day, and more often if much concrete is being used or if the air content varies. It should be remembered that entrained air does not obviate the necessity for observing the other basic principles.

Ready-mix concrete is being used more and more on the railroads. It offers them many advantages, but there are still certain precautions that should be taken to insure its quality. Customary practice is to order ready-mix concrete by strength without any other requirements. Since durability is generally more important than strength, it generally is good practice to state the minimum cement factor and the maximum water content required in addition to the strength.

One of the best ways of insuring that the basic principles are observed on any concrete job is to provide good competent inspectors. This means men who know and understand the fundamentals of making quality concrete and who have the authority to use whatever methods are required to get it. Good inspection is a sound investment in quality concrete and its value should not be overlooked. Another method of insuring the desired results is to instruct the field forces in the fundamentals of making quality concrete. Some roads are doing this by conducting short courses of two or three days' duration on the subject. All of the fundamentals of making quality concrete are thoroughly reviewed and the men actually have an opportunity to design mixes, make trial batches and perform slump tests.

If durable concrete is wanted then it is important to furnish the field forces with suitable equipment for making the concrete and controlling its quality. The man should be shown how to use the equipment correctly and its purpose should be explained to them.

Too often crude methods of batching, handling and placing the concrete are still in use on many roads. Yet those same roads wonder why they sometimes have to spend good money to repair this concrete.

Durable concrete can be made readily, however, it takes someone who knows how to do it and who has the equipment to do the job right.

In answer to a question raised by W. A. Huckstep (MP), Mr. Paris said that finishes that are "dusted on" fresh concrete are never satisfactory because they "dust off" quickly.

To questions raised by W. R. Weaver (Pitts.&Shaw.), Lee Mayfield (MP) and E. H. Barnhart (B&O) relative to ready-mix concrete, Mr. Paris said that such concrete should be delivered within an hour after mixing, although concrete is still good as long as it is plastic enough to place in the forms. Mixing time can be timed better on long hauls by the trucks which are equipped with separate water containers so that water can be introduced as the truck approaches the site. It is not harmful for the mixing drum to rotate the dry aggregates on these trucks as long as the aggregates do not segregate. If concrete is delivered and stands in the buggies before placing, it should be protected from the sun, Mr. Paris said.

J. A. Jorlett (PRR) asked if airentrained concrete can be mixed too long and Mr. Paris said that the length of time has little effect on the resultant concrete because it will retain a constant of about 4 per cent of air bubbles.

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	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938-1939	1939-1940	1940-1941	1941-1942
President	Armstrong Chinn	A. E. Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres.	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres.	A. E. Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres.	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres.	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.	C. A. Lichty	C. A. Lichty		
Secretary	....	....	F. O. Whiteman	A. G. Shaver
Treasurer	....	....	F. E. Weise	F. E. Weise
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

	1942-1943	1943-1944	1944-1945	1945-1946
President	G. S. Crites	J. L. Varker	J. L. Varker	N. D. Howard
1st V.-Pres.	R. E. Caudle	R. E. Caudle	R. E. Caudle	F. G. Campbell
2nd V.-Pres.	A. M. Knowles	N. D. Howard	N. D. Howard	J. S. Hancock
3rd V.-Pres.	N. D. Howard	F. G. Campbell	F. G. Campbell	E. H. Barnhart
4th V.-Pres.	J. L. Varker	J. S. Hancock	J. S. Hancock	W. F. Martens
Secretary	A. G. Shaver† Lorene Kindred‡ Elinor V. Heffern	Elinor V. Heffern	Elise LaChance	Elise LaChance
Treasurer	F. E. Weise	C. R. Knowles	C. R. Knowles	C. R. Knowles
Treasurer Emeritus		F. E. Weise	F. E. Weise	
Directors	M. Meyer	W. F. Martens	W. F. Martens	A. B. Chapman
	L. E. Peyser	A. L. McCloy	A. L. McCloy	W. A. Huckstep
	K. L. Miner	L. C. Winkelhaus	L. C. Winkelhaus	F. R. Spofford
	F. G. Campbell	E. H. Barnhart	E. H. Barnhart	Guy E. Martin
	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

†To November 1, 1942
‡To February 1, 1943

	1946-1947	1947-1948	1948-1949	1949-1950
President	F. G. Campbell	J. S. Hancock	E. H. Barnhart	W. F. Martens
1st V.-Pres.	J. S. Hancock	E. H. Barnhart	W. F. Martens	W. A. Huckstep
2nd V.-Pres.	E. H. Barnhart	W. F. Martens	W. A. Huckstep	Guy E. Martin
3rd V.-Pres.	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres.	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	C. R. Knowles	C. R. Knowles	L. C. Winkelhaus	L. C. Winkelhaus
Directors	Guy E. Martin	H. M. Harlow	Lee Mayfield	H. M. Harlow
	B. R. Meyers	H. B. Christianson	F. M. Misch	V. E. Engman
	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

	1950-1951	1951-1952
President	W. A. Huckstep	Guy E. Martin
1st V.-Pres.	Guy E. Martin	F. R. Spofford
2nd V.-Pres.	F. R. Spofford	Lee Mayfield
3rd V.-Pres.	Lee Mayfield	H. M. Harlow
4th V.-Pres.	H. M. Harlow	J. A. Jorlett
Secretary	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus
Directors	F. M. Misch	M. H. Dick
	L. R. Morgan	R. R. Gunderson
	J. A. Jorlett	J. F. Warrenfells
	M. H. Dick	W. H. Huffman
	R. R. Gunderson	L. R. Morgan
	J. F. Warrenfells	B. M. Stephens

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussions unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1. The membership of this association shall be divided into five classes, viz: Members, life members, associate, honorary and junior members.*

Section 2.** A member shall be a person in a position above rank of gang foreman in connection with railway bridge, building and water service work. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

Section 3.** To be eligible for a life membership a member must have belonged to the association for at least twenty years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of active membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2, of this Article.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of active members except that of holding office and shall be exempt from the payment of dues.

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*Amended October 16, 1941.

**Amended September 20, 1948.

Section 6. A junior member shall be a person who is a graduate of a recognized engineering school, or who has been employed for at least two years in the design, maintenance or construction of railway bridges, buildings or structures. Applicants shall be at least 21 years of age and they shall be elected in the manner prescribed for members, in Section 2 of this article. Juniors shall have all the rights of members except that of holding office. When the attainments of a Junior are such as to qualify him as a member, he may apply for promotion and the Executive Committee shall authorize such promotion when qualifications warrant the action. Unless a Junior is promoted, his membership shall cease automatically when he becomes 28 years of age.*

Section 7. Any member guilty of conduct unbecoming to a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 8. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 9.** Only active members shall hold office in this association, and only active and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1. The officers of this association shall be a president, four vice-presidents, a secretary, a treasurer and six directors who with the most recent past president shall constitute the executive committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members, shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE

Section 1. Except as otherwise provided, the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for reëlection.

*Amended October 16, 1941.

**Amended September 20, 1948.

Section 2.† The president, four vice-presidents, secretary and treasurer shall hold office for one year and the directors for two years, three directors being elected each year. All officers retain their offices until their successors are elected and installed.

Section 3.† The term of office of the secretary and the treasurer may be terminated at any time by a two-thirds vote of the executive committee. Their compensation shall be fixed by a majority vote of the executive committee.

The secretary shall also serve as secretary of the executive committee.

Section 4. The secretary and the treasurer shall be required to give bond in an amount to be fixed by the executive committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1.† Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears may be stricken from the list of members at the discretion of the executive committee.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee of the association approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

BY-LAWS

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the Executive Committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall lie within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

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†Amended October 17, 1940.
*Article adopted 1922.
**Amended September 20, 1948.

**DUES

5. The annual dues, for the fiscal year ending August 31, and payable in advance, shall be as follows:*

Members, $5.00; Associate Members, $4.00; Junior Members, $2.50.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts, between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10.♯ After each annual meeting the president shall appoint a committee consisting of five members. Two Past Presidents shall be members of this committee, one of whom shall act as Chairman. No other officers of the Association shall be appointed to this committee. This committee shall prepare a list of names of nominees for officers to be voted on at the next annual convention in accordance with ARTICLE VI of the Constitution, said list to be read at the business session of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

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†Amended October 17, 1940.
‡Adopted October 17, 1940.
*Amended October 16, 1941.
**Amended September 20, 1948.
♯Amended December 4, 1950.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to coöperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDER OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise, all discussions shall be governed by Robert's rules of order.

AMENDMENTS

17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called Executive Committee Meeting.

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†Amended September 20, 1948.

DIRECTORY OF MEMBERS

as of February 1, 1953

(Figure after each name indicates year when member joined the association)

HONORARY MEMBERS

Bechtelheimer, A. E., (Retired) Br. Engr., C. & N. W., Chicago, Ill. (1920)
Budd, Ralph, (Retired) President, C. B. & Q. Chicago, Ill. (1927)
Buford, C. H., (Retired) President, C. M. St. P. & P., Washington, D. C. (1946)
Chinn, Armstrong, President, T. R. R. A. of St. L., St. Louis, Mo. (1930)
Crites, G. S., (Retired) Div. Engr., B. & O., Baltimore, Md. (1912)
Strate, T. H., (Retired) Div. Engr., C. M. St. P. & P., Chicago, Ill. (1918)
Vandenburgh, E. C., (Retired) Ch. Engr., C. & N. W., Chicago, Ill. (1925)

ACTIVE MEMBERS

A

Aaron, H. C., Supv. B. & B., W. M., Hagerstown, Md. (1935)
Allen, G. A., Supv. B. & B., C. & O., Columbus, Ohio (1952)
Alvord, J. L., Dist. Per. Off., C. & O., Saginaw, Mich. (1950)
Anderson, A., Spec. Asst. Engr., N. Y. C., Chicago, Ill. (1947)
Anderson, A. C., Gen. B. & B. For., D. M. & I. R., Two Harbors, Minn. (1952)
Anderson, J. L., Supv. B. & B., M. P., Osawatomie, Kan. (1931)
Aedrews, J. T., Spl. Engr., B. & O., Baltimore, Md. (1947)
Armstrong, W. F., Asst. Arch'l. Engr., C. & N. W., Chicago, Ill. (1947)
Atkinson, T. J., Supv. of Struc., Penna., Pittsburgh, Pa. (1947)

B

Babbitt, J. H., Div. Engr., B. & O., Indianapolis, Ind. (1946)
Baker, B., Asst. Supv. B. & B., C. & O., Saginaw, Mich. (1950)
Baker, R. C., Engr. of Struc., C. & E. I., Danville, Ill. (1940)
Barnhart, E. H., (Retired), Div. Engr. M. of W., B. & O., St. Petersburg, Fla. (1941)
Barr, H. L., Div. Engr., C. & N. W., Boone, Ia. (1938)
Barranco, S. J., Asst. Supv. Struc., Penna., Pittsburgh, Pa. (1951)
Beam, Y. C., Asst. Mast. Carp., S. A. L., Americus, Ga. (1945)
Beaver, J. F., Ch. Engr. M. of W. & Struc., Sou., Charlotte, N. C. (1951)
Beck, R F., Asst. Engr., E. J. & E., Joliet, Ill. (1952)
Begeman, W. H., Supv. B. & B., M. P., Jefferson City, Mo. (1941)
Benjamin, H. I., Vice Chair. Sys. Com. on Ins., S. P., San Francisco, Calif. (1922)
Benson, C. E., Gen. For. B. & B., E. J. & E., Chicago, Ill. (1951)
Benson, G. W., Supt. Br., C. of Ga., Macon, Ga. (1940)
Benson, O. C., Asst. Div. Engr., B. & M., Concord, N. H. (1952)
Bergeron, J. A., Asst. B. & B. Mast., C. N., Cochrane, Ont., Can. (1949)
Beringer, M. A., Br. Inspr., I. C., Chicago. Ill. (1929)
Beynon, H. G., B. & B. Mast., C. P., Brandon, Man., Can. (1951)
Bingaman, C. E., Mast. Carp., Reading, Tamaqua, Pa. (1948)
Bisbee, R. D., Div. Engr., P. & S. F., Slaton, Texas (1947)
Blankenship, O. H., W. S. For., M. P., Poplar Bluff, Mo. (1948)
Blewer, E. H., Asst. Supt. of Safety, N. Y. C,. New York, N. Y. (1937)
Bliss, J. J., Gen. B. & B. For., B. Ry. Co. of C. Chicago, Ill. (1950)
Block, M., Engr. of Br., I. C., Chicago, Ill. (1948)
Bober, H., B. & B. Engr., G. M. & O., Mobile, Ala. (1947)
Bodie, B. V., Ch, Engr., G. M. & O., Mobile, Ala. (1951)
Boehling, H. A., Jr., Asst. Cost. Engr., C. & O., Richmond, Va. (1948)
Bogle, W. H., Engr. M. of W., P. T. R. R. Assn., Houston, Tex. (1951)
Boling, E. C., Supv. B. & B., N. S., Cary, N. C. (1950)
Borchert, W. C., Div. Engr., K. C. S., Shreveport, La. (1942)
Bost, M. A. (Retired), Asst. Engr., C. M. St. P. & P., Mason City, Ia. (1935)

Brandimarte, J. J., Jr., Supv. Struc., Penna., Cleveland, Ohio (1947)
Brice, W. T., B. & B. Mast., C. N., Regina, Sask., Can. (1946)
Bridjette, E. C., Sr. Asst. B. & B. Supv., S. P., Los Angeles, Calif. (1950)
Brouse, R. G., Sr., Mast. Carp., C. B. & Q., Chicago, Ill. (1951)
Brown, I. D., Insp. W. S., C. & O., Huntington, W. Va. (1952)
Brown, L. W., B. & B. Supv., C. & O., Peru, Ind. (1951)
Brown, T. W., Ch. Water Chem., I. C., Chicago, Ill. (1947)
Buckmaster, W. A., Asst. Div. Engr., B. & O. C. T., Chicago, Ill. (1951)
Budzenski, F. N., Asst. Supv. B. & B., C. & N. W., Antigo, Wis. (1938)
Bunch, A. H., Br. Inspr., St. L.-S. F., Springfield, Mo. (1951)
Bunge, W. H., Asst. Engr., M. P., Houston, Tex. (1941)
Burch, E. E., Br. Engr., C. M. St. P. & P., Chicago, Ill. (1945)
Burford, A. E., Gen. For. B. & B., I. C., Memphis, Tenn. (1947)
Burke, W. R., Supv. B. & B., I. C., Champaign, Ill. (1947)
Burkel, J. N., Draftsman, M. P., St. Louis, Mo. (1951)
Burks, C. H., Div. Engr., S. A. L., Jacksonville, Fla. (1951)
Burrows, C. D., Mast. Carp., B. & O., Wilmington, Del. (1946)
Bush, R. H., W. S. Supv., T. & N. O., Ennis, Tex. (1952)

C

Caines, W. W., Supv. B. & B., C. & O., Huntington, W. Va. (1938)
Caldwell, F. O., Mast. Carp., S. A. L., Raleigh, N. C. (1951)
Campbell, F. G., Ch. Engr., E. J. & E., Joliet, Ill. (1936)
Campbell, J. A., Supv. of Struc., Penna and P. R. S. L., Camden, N. J. (1951)
Carlon, J. G., Asst. Supv. B. & B., C. & O., Russell, Ky. (1947)
Carothers, M. D., Asst. Ch. Engr., G. M. & O., Bloomington, Ill. (1938)
Carter, J. W., B. & B. Supv., Virginian, Roanoke, Va. (1947)
Chamberlain, P. C., Asst. to Engr. of Struc., Erie, Cleveland, Ohio (1941)
Chaney, A. B., Asst. Ch. Engr. Sys. Mtce., M. P., St. Louis, Mo. (1947)
Chapin, S. L., Safety Supv., S. P., San Francisco, Calif. (1946)
Christianson, H. B., Asst. Ch. Engr. Sys., C. M. St. P. & P., Chicago, Ill. (1928)
Clark, K. L., Prin. Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1939)
Clapper, L., Ch. Engr., D. M. & I. R., Duluth, Minn. (1919)
Cole, G., B. & B. Gen. For., A. T. & S. F., Emporia, Kan. (1949)
Collette, E. L. Sr., Div. Engr., St. L.-S. F., Ft. Smith, Ark. (1949)
Collier, P. B., Supt. of Scales, M. P., St. Louis, Mo. (1938)
Collum, R. L., Mast. Carp., S. A. L., Jacksonville, Fla. (1941)
Colvin, A. A., Div. Engr., C. & N. W., Norfolk, Neb. (1937)
Colvin, C. S., Asst. Engr. of Struc., M. P., Houston, Tex. (1951)
Coombs, G. B., Gen. For. B. & B., A. T. & S. F., Fresno, Calif. (1951)
Converse, D. W., Br. Engr. A. C. & Y., Akron, Ohio (1940)
Cook, E. F., W. S. For., M. P., Little Rock, Ark. (1947)
Cooper, L. L., Mast. Carp., B. & O., Indianapolis, Ind. (1952)
Corporon, F. J., Supt. W. & Struc., C. S. S. & S. B., Michigan City, Ind. (1950)
Cox, R. C., B. & B. Supv., W. P., Sacramento, Calif. (1950)
Cramer, F. H., Br. Engr., C. B. & Q., Chicago, Ill. (1927)
Crews, C. H., Supv. B. & B., I. C., Jackson, Tenn. (1947)
Croft, P. H., Asst. Engr. M. of W., I. C., Memphis, Tenn. (1947)
Crounse, W. E., B. & B. Supv., D. & H., Carbondale, Pa., (1945)
Cruikshank, A. W., Gen. Plumb. For., D. & H., Green Island, N. Y. (1950)
Cummings, J. W., Supv. Wk. Equip., D. & H., Albany, N. Y. (1947)
Cummings, C. P., Asst. Engr., M. K. T., St. Louis, Mo. (1948)
Cunningham, J. F., Ch. Br. Insptr., B. & M., Boston, Mass. (1951)
Curie, H. D., Mast. Carp., B. & O., Garrett, Ind. (1942)

D

Davis, G. B., B. & B. Supv., N. Y. C., Columbus, Ohio (1942)
Davis, G. M., Asst. Supv. B. & B., N. Y. C., Corning, Ohio (1951)
Davis, H. E., B. & B. Supv., N. Y. C. Sys., Chicago, Ill. (1940)
Davis, L. H., Gen. For. B. & B., A. T. & S. F., Amarillo, Tex. (1948)
Day, F. D., Supv. Struc., Penna., New York, N. Y. (1949)
Dedow, R. T., Draftsman, N. Y. C., Detroit, Mich. (1950)
Demmon, H. R., Asst. Gen. B. & B. Insptr., S. P., Albany, Calif. (1948)
Deno, A. H., B. & B. Supv., C. & N. W., Green Bay, Wis. (1941)
Deno, L. J., Div. Engr., C. & N. W., Escanaba, Mich. (1947)
Derry, L. N., Steel Insp., B. & M., Boston, Mass. (1951)
DeWalt, A. R., Off. Engr., Penna., Cleveland, Ohio (1949)
Dick, H. M., Supv. of Struc., Penna., Harrisburg, Pa. (1942)

Dick, M. H., Ed., Ry. Trk. & Struc., Chicago, Ill. (1937)
Dixon, N., B. & B. Mast., C. N., Montreal, Que., Can. (1949)
Dodson, F., Asst. Supv. B. & B., C. & O., Covington, Ky. (1948)
Dougherty, J. L., Supv. B. & B., W. M., Cumberland, Md. (1944)
Dove, R. E., Assoc. Ed., Ry. Trk. & Struc., Chicago, Ill. (1934)
DuBose, C. R., Res. Engr., M. P., Houston, Tex. (1948)
Duchac, J. V., Supv. B. & B., C. & N. W., Antigo, Wis. (1927)
Dulik, A. E., Gen. For. B. & B., Penna., Harrisburg, Pa. (1950)
Dunnagan, J. P., Engr. of Br., S. P., San Francisco, Calif. (1943)
Duresky, F., Jr., Supv. B. & B., C. & N. W., Huron, S. D. (1942)

E

Ebbens, J., Supv. B. & B., C. & W. I., Chicago, Ill. (1947)
Edlung, O. F., Supv. of W. S. & Equip., B. Ry. Co. of C., Chicago, Ill. (1950)
Eichenlaub, C. M., Res. Engr., S. D. & A. E., San Diego, Calif. (1943)
Eisele, C., Asst. Engr., N. Y. C., Chicago, Ill. (1930)
Elliott, C. E., Div. Engr., W. P., Sacramento, Calif. (1950)
Elower, L., Trav. Br. Insp., Erie, Owego, N. Y. (1948)
Enger, E. M., Supv. B. & B., C. St. P. M. & O., St. Paul, Minn. (1947)
Engman, N. V., Asst to Sec., A. R. E. A., Chicago, Ill. (1949)
Erickson, O., Asst. B. & B. Supv., S. P., Sacramento, Calif. (1950)
Ernst, F. A., Div. Engr., B. & O., Pittsburgh, Pa. (1949)
Ester, E. J., Asst. Supv. B. & B., N. Y. C., Indianapolis, Ind. (1951)
Everett, P. H., Asst. Supt. Fire Prev., I. C., Chicago, Ill. (1952)

F

Ferry, M. H., Mast. Carp., Erie, Hornell, N. Y. (1952)
Fiducia, S. F., Architect, N. Y. C., Detroit, Mich. (1950)
Firehammer, L. M., Supv. B. & B., Ill. Term., Springfield, Ill. (1919)
Fisher, D. H., Asst. Engr., C. M. St. P. & P., Elmwood Park, Ill. (1952)
Fisher, G. R., B. & B. Mast., C. N., Stratford, Ont., Can. (1949)
Ford, A. N., Supv. Bldg. Repairs, A. C. L., Savannah, Ga. (1950)
Forseth, C. E., Div. Engr., W. P., Elko, Nev. (1950)
Fouts, K., Gen. For. B. & B. & W. S., St. L-S. F. Chaffee, Mo. (1948)
Fox, R. L., Div. Engr., Southern, Alexandria, Va. (1935)
Friets, C. G., Supt. B. & B., C. & N. W., Escanaba, Mich. (1938)
Fronabarger, H. C., B. & B. Supv., T. & P., Ft. Worth, Tex. (1949)
Frost, L. M., Supv. B. & B., G. T. W., Battle Creek, Mich. (1938)
Fuhr, W. E., Div. Engr., C. M. St. P. & P., Savanna, Ill. (1948)
Fuller, T. L., Struct. Designer, T. & N. O., Houston, Tex. (1952)
Furniss, B. J., B. & B. Supv., N. Y., N. H. & H., Hartford, Conn. (1946)

G

Gabrio, C. W., Br. Engr., Virginian, Norfolk, Va. (1947)
Gannon, J. P., Div. Engr., M. St. P. & S. S. M., Stevens Point, Wis. (1947)
Garcelon, C. E., B. & B. Supt., B. & A., Houlton, Me. (1945)
Garis, L. D., Gen. Br. Insp., C. & N. W., Chicago, Ill. (1930)
Gearhart, G. W., Asst. Supv. B. & B., N. W., Roanoke, Va. (1950)
Geyer, C. J., Vice Pres., C. & O., Huntington, W. Va. (1928)
Gilbert, L. C., Sr. Engr., E. J. & E., Joliet, Ill. (1950)
Gillespie, W. G., Mast. Carp., B. & O., Grafton, W. Va. (1946)
Gilmore, R. W., Gen. Br. Insp., B. & O., Cincinnati, Ohio (1943)
Gladwin, F. E., B. & B. Supv., N. W. P., San Rafael, Calif. (1950)
Glander, A. M., Ch. Carp., C. M. St. P. & P., Mason City, Ia. (1936)
Goodin, D. W., Asst. Supv. B. & B., N. Y. C., Columbus, Ohio (1951)
Goodman, J. R., Asst. Tr. Mast., Southern, Chamblee, Ga. (1951)
Gossard, J. T., Supv. B. & B., W. M., Hagerstown, Md. (1952)
Graham, H. E., Asst. Supt. W. S., I. C., Chicago, Ill. (1946)
Graham, W. R., Asst. Supv. B. & B., C. & O., Covington, Ky. (1946)
Greene, E. A.,Asst. Supv. B. & B., B. & M., Greenfield, Mass. (1951)
Greene, H. P., Supv. Struct., Penna., Philadelphia, Pa. (1947)
Gunderson, R. R., Asst. Br. Engr., Southern, Washington, D. C. (1947)
Gustafson, J. M., Br. Engr., M. & St. L., Minneapolis, Minn. (1949)

H

Hagenmaier, C. E., Asst. B. & B. Supv., S. P., Los Angeles, Calif. (1950)
Hailey, S. H., Sr. Asst. Engr., N. C. & St. L., Nashville, Tenn. (1948)
Haines, P. D., B. & B. Supv., C. & O., Saginaw, Mich. (1943)

Hamill, A., B. & B. Mast., E. & N., Victoria, B. C., Can. (1949)
Hamilton, C. W., Engr. of Design, Wabash, St. Louis, Mo. (1950)
Hampton, A. A., Asst. Supv. B. & B., M. P., DeQuincy, La. (1947)
Hancock, J. S., Br. Engr., D. T. & I. R., Dearborn, Mich. (1916)
Harding, C. R., President, The Pullman Co., Chicago, Ill. (1924)
Harlow, H. M., Asst. Gen. Supv. B. & B., C. & O., Richmond, Va. (1939)
Harman, H. C., Supv. B. & B., S. P., San Francisco, Calif. (1911)
Harp, M. J., Supv. B. & B., M. P., Poplar Bluff, Mo. (1938)
Harris, A. R., Engr. Br., C. & N. W., Chicago, Ill. (1940)
Hartley, L. M., Mast. Carp., S. A. L., Tampa, Fla. (1949)
Hartman, G. F., Asst. Supv. B. & B., C. & O., Columbus, Ohio (1947)
Harwood, M. S., Asst. B. & B. Supv., S. P., San Francisco, Calif. (1948)
Hawkins, C. L., Asst. Supv. Structs., Penna., Pittsburgh, Pa. (1950)
Healy, J. J., Asst. B. & B. Supv., B. & M., Boston, Mass. (1947)
Heck, J. E., Supt. B. & B., C. & O., Ashland, Ky. (1938)
Hecker, R. L., B. & B. Supv. & W. S. Supv., C. & O., Grand Ledge, Mich. (1947)
Hedley, W. J., Asst. Ch. Engr., Wabash, St. Louis, Mo. (1950)
Hefte, A., Asst. B. & B. Supv., N. W. P., San Rafael, Calif. (1952)
Hellweg, R. D., Asst. Div. Engr., G. M. & O., Bloomington, Ill. (1947)
Hemstad, B., Mast. Carp., G. N., Willmar, Minn. (1937)
Herrick, H. R., Sr. Asst. B. & B. Supv., S. P., El Paso, Tex. (1950)
Hewitt, F. W., Dist. For., C. of Vt., West Townsend, Vt. (1951)
Hickok, B. M., Supv. B. & B., N. Y. C., Cleveland, Ohio (1951)
Hildebrand, H. S., Supv. of Struct., Penna., Buffalo, N. Y. (1952)
Hillman, A. B., Ch. Engr., B. Ry. Co. of C., & C. & W. I., Chicago, Ill. (1942)
Hiner, J. T., B. & B. Supv., Southern, Greenville, S. C. (1950)
Hodnett, E. F., Asst. Engr., M. P., Houston, Tex. (1951)
Hofstetter, P. W., Asst. B. & B. Supv., M. P., San Antonio, Tex. (1946)
Holmes, E. J., Mast. Carp., Erie, Huntington, Ind. (1952)
Hornig, F. F., Div. Engr., C. M. St. P. & P., Sioux City, Ia. (1947)
Hornug, K. E., Architect, C. M. St. P. & P., Chicago, Ill. (1949)
Howard, N. D., Secretary, A. R. E. A., Chicago, Ill. (1926)
Howard, W. A., Asst. B. & B. Supv., T. & N. O., Ennis, Tex. (1950)
Hoyt, A. C., Engr. B. & B., E. J. & E., Joliet, Ill. (1947)
Hubbard, M. J., Gen. Supv. B. & B., C. & O., Richmond, Va. (1948)
Huckaby, V. T., Steel Br. Inspt., M. K. T., Hillsboro, Tex. (1947)
Huckstep, W. A., Gen. Bldg. Supv., M. P., St. Louis, Mo. (1941)
Huffman, W. H., Div. Engr., C. & N. W., Chicago, Ill. (1941)
Hull, F. G., B. & B. Supv., C. & O., Blenheim, Ont., Can. (1947)
Humphreys, R. W., Div. Engr., N. P., Missoula, Mont. (1947)
Huntsman, F. C., Asst. Engr., Wabash, St. Louis, Mo. (1922)
Huston, P. F., Mast. Carp., C. & S., Denver, Colo. (1948)
Hutcheson, F. W., Supv. B. & B., C. & O., Newport News, Va. (1938)
Hutcheson, W. A., Supv. Wk. Equip., C. & O., Clifton Forge, Va. (1939)
Hutchings, V. W., B. & B. Supv., S. P., Bakersfield, Calif. (1941)
Hutchinson, D. G., B. & B. Insp., W. P., Elko, Nev. (1950)
Hutto, J. E., Res. Engr., S. A. L., Savannah, Ga. (1951)

I

Inabinet, J. V., Gen. Br. Insp., S. A. L., Jacksonville, Fla. (1948)

J

Jackman, H. E., Mast. Carp., B. & O., Chillicothe, Ohio (1944)
Jackson, S. M., Prin. Asst. Engr., M. P., Houston, Tex. (1951)
Jackson, T. E., Gen. B. & B. Supv., S. P., San Francisco, Calif. (1942)
Jarratt, M., W. & F. Supv., S. P., Tucson, Ariz. (1950)
Jenkins, D. H., B. & B. Supv., St. L. S. W., Pine Bluff, Ark. (1950)
Jenkins, H. W., Asst. to Ch. Engr., N. Y., N. H. & H., New Haven, Conn. (1940)
Johnson, A. C., Engr. of Design, E. J. & E., Joliet, Ill. (1944)
Johnson, A. J., Act'g. Mast. Carp., B. & O., Garrett, Ind. (1950)
Johnson, B. O., Off. Engr., C. M. St. P. & P., Chicago, Ill. (1931)
Johnson, D. H., Supv. B. & B., C. M. St. P. & P., Altoona, Wis. (1940)
Johnston, G. H., Gen. For. B. & B., A. T. & S. F., Marceline, Mo. (1950)
Jones, A. C., B. & B. Supv., Southern, Birmingham, Ala. (1938)
Jones, E. B., Br. Insp., C. & O., Clifton Forge, Va. (1945)
Jones, F. Gen. For. B. & B., & W. S., St. L. - S. F., Chaffee, Mo. (1952)
Jorlett, J. A., Asst. Engr., Penna., New York, N. Y. (1946)

K

Karwich, W. P., Trav. B. & B. Insp., Erie, Wadsworth, Ohio (1948)
Kaylor, F. M., B. & B. Supv., G. S. & F., Valdosta, Ga. (1952)
Kelly, J. R., B. & B. Supv., Southern, Lexington, Ky. (1952)
Kemmerer, W. G., Asst. Engr. B. & B., Penna, New York, N. Y. (1931)
Kendall, J. T., Spec. Duty For., Penna., Terre Haute, Ind. (1949)
Kiley, W. E., Asst. Supv. B. & B., B. & M., Boston, Mass. (1951)
Klingaman, C. C., Mast. Carp., Reading, Reading, Pa. (1951)
Klinger, T. R., Prin. Asst. Engr., M. St. P. & S. S. M., Minneapolis, Minn. (1951)
Knapp, P., Mast. Carp., Erie, Jersey City, N. J. (1951)
Koehler, P. L., Sup. Simp. Transp. Dept., C. & O., Huntington, W. Va. (1938)
Koenig, M. E., Div. Engr., C. St. P. M. & O., St. Paul, Minn. (1951)
Krefting, A. S., Prin. Asst. Engr., M. St. P. & S. S. M., Minneapolis, Minn. (1935)
Kruse, H. H., Ch. Carp., C. M. St. P. & P., Miles City, Mont. (1947)
Kvenberg, S. E., Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1932)

L

La Bat, J. J., Supv. B. & B., M. P., Wichita, Kan. (1937)
Laird, C. W., Scale Supt., M. P., Houston, Tex. (1947)
Lamport, L. R., Ch. Engr. Mtce., C. & N. W., Chicago, Ill. (1935)
Lampson, W. Supv. B. & B., M. C., Portland, Me. (1930)
Lane, H. W., Supv. B. & B., E. J. & E., Joliet, Ill. (1952)
Langford, W. A., Asst. Supv. B. & B., M. P., Monroe, La. (1948)
Larson, K. Supv. B. & B., C. & N. W., Sioux City, Ia. (1947)
Layman, D. C., Gen. B. & B. For., I. C., Memphis, Tenn. (1952)
Leak, V. L., Gen. For. B. & B. & W. S., St. L. - S. F., Tulsa, Okla. (1948)
LeClaire, N. C., Supt. B. & B., T. R. R. A., of St. L., St. Louis, Mo. (1952)
****Lederer, C. C.,** Designer B. & B. Dept. N. Y. C. Sys., Wayne, Mich. (1949)
Lee, F. L., Supt. of Struct., Penna., Cincinnati, Ohio (1951)
Lee, J. D., Asst. Engr., N. Y. C., Detroit, Mich. (1952)
Lehman, H. G., Sr. Asst. B. & B. Supv., S. P., San Francisco, Calif. (1950)
Leinweber, F. J. A., B. & B. Mast., C. N., St. Thomas, Ont., Can. (1947)
Lieser, H. J., Trk. Supv., B. Ry. Co. of C., Chicago, Ill. (1948)
Lingle, T. N., Gen. For. B. & B., I. C., Carbondale, Ill. (1951)
Linn, G. A., Div. Engr., C. & N. W., Chadron, Neb. (1940)
Little, H. C., Supv. of W. S., I. C., Vicksburg, Miss. (1948)
Lokotzke, G. P., Supv. B. & B., E. J. & E., Gary, Ind. (1947)
Loper, L. E., Asst. Mast. Carp., Erie, Hornell, N. Y. (1951)
Lorber, R. J., Supv. B. & B., P. & P. U., Peoria, Ill. (1948)
Lord, H. T., B. & B. Mast., C. P., Kenora, Ont., Can. (1940)
Lorence, H. B., Fire Prot. Engr., C. R. & I., (Gibson,) Hammond, Ind. (1950)
Lowry, J. M., Asst. to Ch. Engr., St. L. S. W., Tyler, Tex. (1950)
Lucas, H. F., Detailer, C. M. St. P. & P., Chicago, Ill. (1952)
Luce, W. L., Mast. Carp., Erie, Youngstown, Ohio (1952)
Luck, R. P., Draftsman, C. & N. W., Chicago, Ill. (1920)
Lund, C. V., Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1947)
Lyon, L. E., Div. Engr., S. P., El Paso, Tex. (1947)

Mc

****McCallum, S. L.,** Arch. Draftsman, M. C., Detroit, Mich. (1952)
McCauley, M. L., Asst. Engr. of Struct., N. Y. C., Elmhurst, Ill. (1950)
McDonald, J. W., Gen. For. B. & B. & W. S., St. L. - S. F., Springfield, Mo. (1947)
McElreath, C. S., B. & B. Supv., Southern, Atlanta, Ga. (1951)
McEwen, R. G., B. & B. Supv., Mo. Ill., Ste. Genevieve, Mo. (1952)
McGrew, B. H., Supv. B. & B., St. L. S. W. of T., Tyler, Tex. (1951)
McGrew, F. O., Ch. Carp, C. M. St. P. & P., Terre Haute, Ind. (1948)
McKee, E. R., Asst. Div. Engr., B. & O., Washington, Ind. (1947)
McKibben, D. H., Asst. Supv. of Struct., Penna., Buffalo, N. Y. (1951)
McNairy, W. H., Asst. Div. Engr., Southern, Charlotte, N. C. (1951)
McNally, P. F., B. & B. Supv., S. P., Ogden, Utah (1948)

M

MacDonald, J. J., Asst. Supv. B. & B., B. & M., Boston, Mass. (1951)
Madson, H. C., Designer, C. & N. W., Chicago, Ill. (1940)
Malmberg, C. R., Asst. Supv. B. & B., C. & N. W., Milwaukee, Wis. (1948)

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* Junior Member

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Manley, B. F., Supv. B. & B., P. E., Los Angeles, Calif. (1943)
Manning, D. A., Supv. B. & B., C. & N. W., Chicago, Ill. (1939)
Manning, W. K., Supv. of Br., Erie, Port Jervis, N. Y. (1948)
Marshall, R. B., Asst. Engr., C. & O., Richmond, Va. (1949)
Martens, W. F., Gen. For. B. & B., A. T. & S. F., San Bernardino, Calif. (1924)
Martin, G. E., Supt. W. S., I. C., Chicago, Ill. (1942)
Martin, J. U., Mast. Carp., S. A. L., Raleigh, N. C. (1946)
Martin, S. L. Asst. B. & B. Supv., T. & N. O., LaFayette, La. (1951)
Martin, T. J., Gen. Mast. Carp., G. N., Seattle, Wash. (1940)
Mason, S. K., Ch. Engr., T. M., Laredo, Tex. (1950)
Mateer, W. G., Mgr. of Pur. & Stores, E. J. & E., Chicago, Ill. (1944)
Mathis, R. C., Br. Insp., I. C., Memphis, Tenn. (1947)
Matthews, A. N., Gen. For. B. & B. & W. S., St. L. - S. F., Fort Scott, Kan. (1947)
Matthews, H. A., Gen. For. B. & B. & W. S., St. L. - S. F., Amory, Miss. (1949)
May, L. E., B. & B. For., A. T. & S. F., Fresno, Calif. (1948)
Mayfield, L. Res. Engr., M. P., Houston, Tex. (1944)
Mays, J. W. N. Jr., Supv. Struct., Penna., Pittsburgh, Pa. (1947)
Meeks, W. R., B. & B. Supv., M. P., Falls City, Neb. (1942)
Meredith, W. E., Supv. Struct., Penna., Columbus, Ohio (1950)
Meserve, E. S., Asst. Supv. B. & B., B. & M., Dover, N. H. (1949)
Merrill, B. W., Supv. B. & B., N. Y. C. & St. L., Conneaut, Ohio (1936)
Meyers, B. R., Ch. Engr., C. & N. W., Chicago, Ill. (1930)
Michael, H. E., Asso. Editor, Ry. Track & Structs., Chicago, Ill. (1947)
Miesenhelder, P. D., Concrete Engr. Research Staff - A.A.R., Chicago, Ill. (1952)
Miller, J. G., Mast. Carp., B. & O., Connellsville, Pa. (1949)
Miller, R. S., Bldg. Supt., C. R. I. & P., Chicago, Ill. (1949)
Minnis, H. D. Jr., Trk. Supv., Southern, Spartanburg, S. C. (1951)
Mitchell, D. N., Asst. Supv. B. & B., C. & O., Newport News, Va. (1948)
Moore, A. J., Br. Insp., M. P., Eunice, La. (1950)
Moore, I. A., Asst. Ch. Engr., C. & E. I., Danville, Ill. (1937)
Moreland, H. B., B. & B. Supv., Southern, Wilton, Ala. (1951)
Morgan, J. H., Engr. M. of W., F. E. C., St. Augustine, Fla. (1948)
Morgan, L. R., Fire Prot. Engr., N. Y. C., Detroit, Mich. (1937)
Morrison, R. H., Prin. Asst. Engr., B. & A., Houlton, Me. (1941)
Moser, C. A., B. & B. Supv., S. N., Sacramento, Calif. (1951)
Mottier, C. H., Vice Pres. & Ch. Engr., I. C., Chicago, Ill. (1942)
Mouhot, P. T., B. & B. Supv., T. & N. O., Lafayette, La. (1952)
Myers, R. L., Supv. W. S., I. C., Clarksdale, Miss. (1950)

N

Neal, G. W., Supt., Chattahoochee Valley, West Point, Ga. (1948)
Neely, Z. D., Mast. Carp., B. & O., Washington, Ind. (1950)
Nelson, R. A., Engr. of Bldgs., C. G. W., Chicago, Ill. (1948)
Nicely, O. P., Asst. Supv. B. & B., C. & O., Clifton Forge, Va. (1950)
Norris, H. Asst. Supv. B. & B., F. E. C., Miami, Fla. (1948)
Norris, M. B. & B. Supv., D. & H., Oneonta, N. Y. (1952)
Norton, R. L., Mast. Carp., S. A. L., Savannah, Ga. (1951)
Nuckols, L. T., Ch. Engr., C. & O., Richmond, Va. (1951)

O

Oest, W. C., Prin. Asst. Engr., Ft. W. & D., Ft. Worth, Tex. (1947)
Olson, V. E., B. & B. Supv., M. St. P. & S. S. M., Stevens Point, Wis. (1948)
Ornburn, B. J., Asst. Ch. Engr. Struct., C. M. St. P. & P., Chicago, Ill. (1948)
Osbourne, T. D., Asst. Gen. Br. Insp., S. P., San Francisco, Calif. (1950)

P

Pahl, W. H., Jr., Asst. Supv. Strucs., Penna., Indianapolis, Ind. (1950)
Park, E., Jr., Draftsman, M. P., Houston, Tex. (1948)
Parrish, E. L., B. & B. Supv., I. C., Vicksburg, Miss. (1947)
Patenaude, E., B. & B. Mast., C. P., Sudbury, Ont., Can. (1930)
Paulson, R. E., Asst. Engr., C. M. St. P. & P., Chicago, Ill. (1945)
Pearson, A. H., Mast. Carp., C. B. & Q., St. Joseph, Mo. (1952)
Pederson, W. E., B. & B. Supv., M. St. P. & S. S. M., Superior, Wis. (1950)
Peek, J. M., Asst. B. & B. Supv., Southern, Greenville, S. C. (1951)
Penhallegon, J. R., Asst. Supv. B. & B., C. & N. W., Chicago, Ill. (1940)
Perry, C., Asst. Supv. B. & B., C. & O., Ashland, Ky. (1950)
Perry, G. H., Supv. Struct., Penna., New York, N. Y. (1948)

Peterson, J. E., Off. Engr., C. & W. I. & B. Ry. Co. of C., Chicago, Ill. (1952)

Peterson, J. C., Sr. Asst. B. & B. Supv., S. P., Sacramento, Calif. (1950)

Peterson, N. E., Ch. Engr., C. & I. M., Springfield, Ill. (1938)

Petteys, W. F., Div. Engr., Erie, Youngstown, Ohio (1948)

Peyser, L. E. (Retired), Architect, S. P., San Francisco, Calif. (1937)

Pfeiffer, A., Asst. B. & B. Supv., S. P., Sacramento, Calif. (1939)

Philips, R. J., Asst. Supv. B. & B., N. Y., N. H. & H., Edgewood, R. I. (1951)

Phillips, B. C., Mast. Carp., C. B. & Q., Alliance, Neb. (1947)

Pinard, T. W., Ch. Engr., L. I., Jamaica, N. Y. (1920)

Plechner, E. J., B. & B. Insp., Reading, Philadelphia, Pa. (1950)

Podas, N. F., Ch. Engr., St. P. U. D. Co. & M. T. Ry. Co., St. Paul, Minn. (1937)

Pound, E. R., Mast. Carp., B. & O., Newark, Ohio (1952)

Preston, C. W., Engr. Prot. Coatings, B. & O,. Baltimore, Md. (1950)

Priest, G. H., Gen. For. B. & B., C. N., Belleville, Ont., Can. (1948)

Prude, G. F., Asst. Supv. B. & B., T. & N. O., Houston, Tex. (1951)

Pryor, W. H., Gen. For. B. & B. & W. S., St. L. - S. F., Memphis, Tenn. (1946)

R

Radford, W. C., Div. Engr., Southern, Richmond, Va. (1951)

Raessler, V. D., Supv. B. & B., I. C., Memphis, Tenn. (1951)

Raley, W. F., Mast. Carp., B. & O., Callery, Pa. (1949)

Ransom, R. D., Div. Engr., C. & N. W., Antigo, Wis. (1950)

Rapier, L. F., Supv. B. & B., G. M. & O., Bloomington, Ill. (1946)

Raver, H. E., Engr. of Struc., L. I., Jamaica, N. Y. (1952)

Reece, A. N., Asst. to the Pres., K. C. S., Kansas City, Mo. (1922)

Reed, F. A., Supv. B. & B., I. C., Clinton, Ill. (1947)

Reese, R. F., B. & B. Supv., T. & N. O., Houston, Tex. (1950)

Rice, E. D., B. & B. Supv., C. & E. I., Danville, Ill. (1949)

Richards, W. T., Engr. Mtce. W. & S., W. P., San Francisco, Calif. (1950)

Richardson, H. B., B. & B. Supv., B. & M., Dover, N. H. (1948)

Rintoul, D. T., Gen Br. Insp., S. P., San Francisco, Calif. (1910)

Robinson, G. E., Engr. Struct., N. Y. C. Sys., Chicago, Ill. (1948)

Robinson, N. R., B. & B. Supv., S. P., Sacramento, Calif. (1934)

Rode, L. A., Gen. Br. Insp., Erie, Newark, N. J. (1948)

Rourke, J. E., Stud. Supv., B. & M., Dover, N. H. (1952)

Routenberg, H. W. (Retired), Mast. Carp., B. & O., Baltimore, Md. (1946)

Ryan, G. M., B. & B. Supv., N. Y., N. H., & H., Boston, Mass. (1947)

S

Safely, J. R., Sr. Asst. B. & B., Supv., S. P., Dunsmuir, Calif. (1945)

Salmon, J. M., Jr., Ch. Engr., Clinchfield, Erwin, Tenn. (1938)

Sathre, C. O., B. & B. Supv., C. & N. W., Madison, Wis. (1950)

Saunders, T. D., Ch. Engr., O. N., North Bay, Ont., Can. (1930)

Saurer, D. E., Asst. Supv. Struct., Penna., Logansport, Ind. (1951)

Sawyer, J. H., Jr., Asst Ch. Engr., C. G. W., Oelwein, Ia. (1951)

Scherer, P. J. Supv. B. & B., S. P., El Paso, Tex. (1936)

Scheumack, J. F., Br. Engr. & Insp., T. & N. O., Houston, Tex. (1950)

Schilt, F. F., Div. Engr., B. & O., Grafton, W. Va. (1946)

Schlaf, E. R., Asst. Supt. W. S., I. C., Chicago, Ill. (1947)

Schmidl, R. M., Asso. Editor, Ry. Track & Strucs., Chicago, Ill. (1952)

Schneider, J. C., B. & B. Supv., T. & N. O., Victoria, Tex. (1950)

Schroeder, A. W., Supt., C. & E. I., Danville, Ill. (1949)

Scites, P. E., Supv. B. & B., C. & O., Huntington, W. Va. (1950)

Seals, R. K., Trk. Supv., Southern, Greensboro, N. C. (1951)

Selvidge, B. F., Asst. B. & B. Supv., M. P.. Van Buren, Ark. (1951)

Setzer, C. M., B. & B. Supv., Southern, Rock Hill, S. C. (1951)

Shackelford, A. D., Div. Engr., C. N., Dauphin, Man., Can. (1950)

Shaefer, L. A., Supv. W. S., M. P., Osawatomie, Kan. (1948)

Sharkey, J. J., Gen. For. B. & B., Penna., Bradley Beach, N. J. (1951)

Shepley, S. H., Asst. Ch. Engr., E. J. & E., Joliet, Ill. (1945)

Shobert, F., Sys. Steel Constr. For., S. P., Oakland, Calif. (1918)

Short, J. M., Gen. W. S. Insp., T. & P., Dallas, Tex. (1950)

Short, W. L., Br. Insp., M. P., St. Louis, Mo. (1951)

Siegfried, F. A., For. Carp., Reading, Reading, Pa. (1947)

Simon, A. H., Engr. of Bldgs., C. B. & Q., Chicago, Ill. (1952)

Sims, C. C., Asst. Supv. B. & B., C. & O., Hinton, W. Va. (1947)

Singer, E. W., Supv. B. & B., N. Y., C. & St. L., Ft. Wayne, Ind. (1923)

Sirel, A. A., Asst. Struct. Engr., A. A. R., Chicago, Ill. (1940)

Skinner, H. E., Supv. Scales & Wk. Equip., E. J. & E., Joliet, Ill. (1944)

Slagle, G. P., Ch. Carp., C. M. St. P. & P., Milwaukee, Wis. (1948)

Smith, C. A., Supv. B. & B., C. R. & I. and I. H. B., Hammond, Ind. (1946)

Smith, E. L., B. & B. Supv., Southern, Hattiesburg, Miss. (1952)

Smith, H. E., Engr. M. of W., G. H. & H., Galveston, Tex. (1941)

Smith, J., B. & B. Supv., S. P., Sacramento, Calif. (1943)

Smith, L. C. (Retired), Div. Engr., C. & N. W., Eagle Grove, Ia. (1942)

Smith, L. L., Asst. B. & B. Supv., S. P., Dunsmuir, Calif. (1948)

Smith, N. E., Asst. Engr., C. M. St. P. & P., Minneapolis, Minn. (1951)

Snyder, E. F., Asst. to Ch. Engr., I. C., Chicago, Ill. (1948)

Spofford, F. R., Asst. to Ch. Engr., B. & M., Boston, Mass. (1940)

Sprengel, H. A., Asst. B. & B. Supv., M. P., Falls City, Nebr. (1950)

Starnes, W. B., Br. Insp., M. P., Kingsville, Tex. (1947)

Steidel, G. T., Br. Engr., L. & N. E., Bethlehem, Pa. (1946)

Stephens, B. M., Asst. Ch. Engr., T. & N. O., Houston, Tex. (1946)

Stephens, O. W., Asst. to Ch. Engr. Mtce., D. & H., Albany, N. Y. (1929)

Stevens, C. M., B. & B. Supv., S. P., Portland, Ore. (1950)

Stewart, F. J. (Retired), Ch. Engr., Port Everglades, Belt Line, Hollywood, Fla. (1944)

Stinebaugh, J. H., Supv. W. S., I. C., Carbondale, Ill. (1951)

Stone, V. E., Fire Insp., N. Y. C., Elkhart, Ind. (1951)

Stoneman, W. Jr., Sr. Asst. B. & B. Supv., S. P., El Cerrito, Calif. (1949)

Strouss, J. A., Asst. Supv. B. & B., S. P., Sacramento, Calif. (1934)

Stutzman, J. W., For. Carp., Reading, Reading, Pa. (1947)

Sumner, J., W. S. For., St. L. - S. F., Springfield, Mo. (1948)

Sweet, W. A., Gen. For. B. & B., A. T. & S. F., Newton, Kan. (1928)

Switzer, G., Asst. Div. Engr., W. P., Sacramento, Calif. (1949)

Switzer, R. E., Gen. For. B. & B. & W. S., G. C. & St. F., Galveston, Tex. (1952)

T

Taggart, C. R., Supv. B. & B., N. Y. C., Indianapolis, Ind. (1935)

Taylor, F. H., Asst. Engr. M. of W. Dept., F. E. C., St. Augustine, Fla. (1951)

Taylor, W. L., B. & B. Supv., Southern, Jasper, Ala. (1950)

Templin, R. S., For. Carp., Reading, St. Clair, Pa. (1947)

Tetrault, L. J., B. & B. For., N. Y., N. H. & H., Worcester, Mass. (1936)

Thelander, P. V., Asst. Ch. Engr., C. & N. W., Chicago, Ill. (1939)

Thurman, S. R., Supv. B. & B., M. P., Nevada, Mo. (1943)

Todd, D. C., Asst. Engr., Penna., Pittsburgh, Pa. (1942)

Tourtellotte, E. B., Supv. B. & B., B. & M., Greenfield, Mass. (1947)

Trulove, J. D., Sr. Asst. B. & B. Supv., S. P., Ogden, Utah (1945)

Tucker, N. R., Asst. Div. Engr., T. & N. O., Austin, Tex. (1939)

Tunison, H. C., Asst. Engr. M. of W., L. & N. E., Bethlehem, Pa. (1946)

Tupper, A. E., B. & B. For., S. P., Stockton, Calif. (1942)

Turner, E. F., For. Steel Const., M. K. T. & M. K. T. of T., Denison, Tex. (1950)

V

Van Ness, R. A., Br. Engr. Sys., A. T. & S. F., Chicago, Ill. (1949)

Varker, J. L., Div. Engr., D. & H., Carbondale, Pa. (1936)

Von Sprecken, R. E., Trk. Supv., Southern, Winston Salem, N. C. (1951)

Von Sprecken, T. M., Asst. to Ch. Engr., Southern, Washington, D. C. (1938)

W

Wager, R. O., Ch. Fire Prot. Engr., N. Y. C., New York, N. Y. (1951)

Wait, R. E., Supv. B. & B., Wabash, Decatur, Ill. (1923)

Walker, G. P., Supv. B. & B., M. P., Monroe, La. (1929)

Walker, S. C., Asst. Supv. of Strucs., Penna., New York, N. Y. (1952)

Wall, E. G., Div. Engr., G. M. & O., Bloomington, Ill. (1942)

Wall, R., Supv. B. & B., Southern, Selma, Ala. (1948)

Wallace, C. E., Gen. For. B. & B. & W. S., St. L. - S. F., Ft. Smith, Ark. (1948)

Wallace, J. E., B. & B. Supv., M. P., St. Louis, Mo. (1950)

Wang, A. B., Supv. B. & B., C. I. & L., Lafayette, Ind. (1950)

Ward, W. G., Asst. Supv. B. & B., C. & N. W., West Chicago, Ill. (1952)

Warfield, W. B., Supv. Struct., Penna., Swissvale, Pa. (1951)

Warner, B. I., Asst. Supv. B. & B., M. C., Portland, Me. (1952)

Warrenfells, J. F., Mast. Carp., S. A. L., Raleigh, N. C. (1946)

Warso, M. M., Engr., Monongahela Connecting, Pittsburgh, Pa. (1948)

Watson, L. W., Dist. Br. Insp., B. & O., Pittsburgh, Pa. (1944)

Weatherly, H. E., Asst. Div. Engr., T. & N. O., El Paso, Tex. (1950)

Weaver, W. R., Asst. Supt., P. & S., Kittanning, Pa. (1951)
Webber, G. R., Ch. Carp., C. M. St. P. & P., Spokane, Wash. (1948)
Welch, J. W., Supv. B. & B., F. E. C., St. Augustine, Fla. (1943)
Wells, W. M., Asst. Div. Engr., B. & O., Washington, Ind. (1946)
Westergren, R. A., Asst. Div. Engr., Penna., Harrisburg, Pa. (1947)
*White, F. N., Jr. Engr., Penna., Aliquippa, Pa. (1951)
White, L. H., Supv. B. & B., I. C., Carbondale, Ill. (1946)
White, S., B. & B. Supv., S. P., Tucson, Ariz. (1942)
Whitehouse, B. M., Ch. Fire Insp., C. & N. W., Chicago, Ill. (1927)
*Widrig, F. F., Asst. Engr., N. Y. C., Detroit, Mich. (1949)
Wiitala, A., Gen. For. B. & B., L. S. & I., Marquette, Mich. (1941)
Wilbur, W., Div. Engr., C. & N. W., Green Bay, Wis. (1947)
Williams, C., Asst. Supv. B. & B., C. & O., Ashland, Ky. (1950)
Williams, N. H., B. & B. Mast., D. & H., Oneonta, N. Y. (1947)
Wilson, R. P., Asst. Supv. B. & B., C. & O., Hinton, W. Va. (1948)
Wilson, W. E., Supv. B. & B., I. R. of C. A., San Salvador, C. A. (1950)
Winkelhaus, L. C., Arch. Engr., C. & N. W., Chicago, Ill. (1934)
Wistrich, H. A., Asst. Ch. Engr., L. V., Bethlehem, Pa. (1938)
Witherspoon, J. P., Mast. Carp., S. A. L., Savannah, Ga. (1948)
Wolfe, J. E., Steel Br. Insp., M. K. T. of T., Denison, Tex. (1950)
Woodward, J. D., Asst.Supv. Strucs., Penna., Pittsburgh, Pa. (1952)
Woodrow, R. F., Asst. Supv. B. & B., Portland Term., Portland, Me. (1951)
Woolford, F. R., Ch. Engr., W. P., San Francisco, Calif. (1950)
Wray, H. O., Sec. & Ch. Engr., T. C. Term., Texas City, Tex. (1939)
Wrights, H., Supv. B. & B., M. P., Little Rock, Ark. (1929)

Y

Yaw, D. M., Mast. Carp., Erie, Buffalo, N. Y. (1951)
Yewell, J. E., Ch. Engr., B. & L. E., Greenville, Pa. (1941)

Z

Zapfe, E. J., Asst. Ch. Engr. & Supt. B. & B., G. B. & W., Green Bay, Wis. (1952)
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Azar, W. J., (Ret.), Supv. B. & B., C. & N. W., c/o B. & B. Supv., C. & N. W., West Chicago, Ill. 1920

B

Batey, W. A., (Ret.), Const. Engr., U. P., 4303 South St., Lincoln Neb. 1918
Buckingham, W., (Ret.), Br. Fore., M. C., 907 Chittock Ave., Jackson, Mich. 1928

C

Canty, J. P., (Ret.), Asst. to Engr. M. of W., B. & M., 40 Prospect St., Melrose, Mass. . . 1901
Christiansen, L., (Ret.), Fore. B. & B., C. M. St. P. & P., 255 So. 11th St., Marion, Ia. . . 1928
Church, H. M., (Ret.), Gen. Supvr. B. & B., C. & O., 509 No. Blvd., Richmond, Va. . . . 1939
Clark, W. A., (Ret.), Off. Engr., D. M. & I. R., 2718 E. 5th St., Duluth 5, Minn. 1908
Corey, S. T., (Ret.), Off. Engr. & Engr. of Br., C. R. I. & P., 7250 Harvard Ave., Chicago 21, Ill. 1913
Cota, G. M., (Ret.), Ch. Clk. Engr. Dept., C. of V., Box 114, St. Albans, Vt. 1913

D

Decker, H. H., (Ret.), Res. Engr., C. & N. W., 2915 Ingersoll Ave., Des Moines, Ia. . . . 1939
Drury, E., (Ret.), Gen. Fore. B. & B., A. T. & S. F., c/o Gen. Fore. B. & B., A. T. & S. F., Newton, Kan. 1919

E

Elwell, H. A., (Ret.), Supt. B. & B., C. G. W., 1735 Marshall Ave., St. Paul, Minn. . . . 1911
Engman, V. E., (Ret.), Ch. Carp., C. M. St. P. & P., 3429 - 17th Ave., So., Minneapolis 7, Minn. 1920

F

Flynn, M. J., (Ret.), Supvr. B. & B., C. & N. W., 2445 Coyle Ave., Chicago 45, Ill. 1905

G

Gehr, B. F., (Ret.), Mast. Carp., Penna., 400 So. 14th St., Richmond, Ind. 1908
Gentis, I., (Ret.), Fore. B. & B., S. P., 2003 West St., Oakland, Calif. 1912
Gerst, H. A., (Ret.), Asst. Engr., G. N., 748 Aldine St., St. Paul 4, Minn. 1917
Gillette, J. E., (Ret.), Carp. Fore., C. M. St. P. & P., c/o Carp. Fore., C. M. St. P. & P. Mazomanie, Wis. 1923
Gillis, A. D., (Ret.), B. & B. Supvr., N. Y. N. H. & H., c/o B. & B. Supvr., N. Y., N. H. & H., Providence, R. I. 1923
Gunderson, E., (Ret.), Supt. B. & B., C. St. P. M. & O., Altoona, Wis. 1927
Guppy, B. W., (Ret.), Engr. Strucs., B. & M., 52 Stratford Rd., Melrose, Mass. 1914

H

Hand, G. W., (Ret.), Asst. to Pres., C. & N. W., 412 Courtland Ave., Park Ridge, Ill. . . 1909
Hartwell, J. R., (Ret.), Supvr. B. & B., C. & N. W., c/o Supvr. B. & B., C. & N. W., Pierre, S. D. 1918
Heiszenbuttel, H., (Ret.), B. & B. Supvr., C. & N. W., 808 So. 3rd St., Norfolk, Neb. . . 1917

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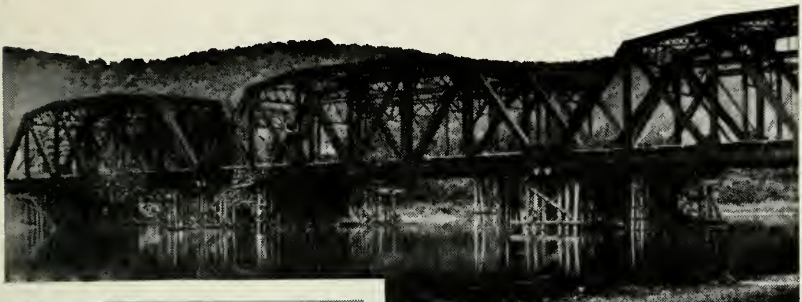

LARGE PHOTO at top shows the new bridge on falsework alongside the old bridge.

SMALL PHOTO shows new bridge in position on piers. Old bridge is on falsework.

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Hofacker, J. P., (Ret.), Supvr. B. & B., L. V., 54 No. Fulton St., Auburn, N. Y. 1907
Horning, H. A., (Ret.), Asst. Supt. Br., M. C., 1106 Francis St., Jackson, Mich. 1902
Howay, B. J., (Ret.), Supvr. B. & B., C. & O., 403 No. Bridge, Grand Ledge, Mich. 1919

J

Johnson, B. L., (Ret.), Gen. Mast. Carp., G. N., 1007 W. 18th St., Spokane, Wash. 1919
Johnson, M., (Ret.), Prin. Asst. Engr., I. C., c/o Casa de Fresa., Hammond, La. 1915
Jones, B. L., (Ret.), Tr. Mast., R. F. & P., c/o Tr. Mast., R. F. & P., Richmond, Va. 1937

K

Kimball, L. P., (Ret.), Engr. Bldgs., B. & O., 5910 S. W. 50th St., Miami 34, Fla. 1921
Knetzger, E. J., (Ret.), Fore. B. B., S. P., 3140 E. 27th St., Oakland 1, Calif. 1926
Koch, H. L., (Ret.), Supvr. B. & B., N. Y. C. & St. L., 637 Main St., Conneaut, Ohio 1922

L

Lacher, W. S., (Ret.), Secretary, A. R. E. A., 407 E. Fuller Rd., Hinsdale, Ill. 1922
Lacy, W. J., (Ret.), Supvr. B. & B., M. P., 4370 Swan St., St. Louis, Mo. 1911
Landstrom, C. A., (Ret.), Supvr. B. & B., C. B. & Q., 1311 S. 3rd St., Burlington, Ia. 1928
Larsen, H. C., (Ret.), Str. Iron Fore., C. St. P. M. & O., 1084 Sims Ave., St. Paul 6, Minn. 1928
Lincoln, S., (Ret.), Gen. Fore. B. & B., G. C. & S. F., 1903 Harrison Ave., Beaumont, Tex. 1927
Lyman, C. R., (Ret.), Fore. B. & B., C. of Vt., Waterbury, Vt. 1913

Mc

McCabe, E. M., (Ret.), Supvr. B. & B., B. & A., Rte. 44, Narrangansett Ave., Pittsfield, Mass. 1915
McKay, A. G., (Ret.), Supvr. B. & B., N. Y., N. H. & H., 11 Pine Island Road, Jupiter Pt. Groton, Conn. 1915
McMahon, T. D., (Ret.), Arch., G. N., 223 Lake Avenue, White Bear Lake 10, Minn. 1918
McNaughton, H. C., (Ret.), Supvr. B. & B., B. & M., c/o Supvr. B. & B., B. & M., Greenfield, Mass. 1915

M

Masters, F. H., (Ret.), Spec. Engr., E. J. & E., 907 Glenwood Ave., Joliet, Ill. 1920
Mead, E. L., (Ret.), Div. Engr., C. & N. W., 536 N. E. 69th St., Miami, Fla. 1923
Mellgren, J., (Ret.), Fore. W. S., C. & N. W., 523 N. Cadwell Ave., Eagle Grove, Ia. 1913
Merwin, P. B., (Ret.), Asst. Engr., C. & N. W., Rte. 2, Box 565, Washougal, Wash. 1929
Miller, C. E., (Ret.), Asst. Engr. M. of W., C. & N. W., 251 Woodland Rd., Highland Pk., Ill. 1916

N

Nies, A. B. (Ret.), Arch., N.Y.C.System, 408 Third St., Jackson, Mich. 1915

O

O'Brien, W. J., (Ret.), Dist. Carp., C.M.St.P. & P., Juneau County, Necedah, Wis. 1919

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R

Rehmert, D. L. (Ret.), Mast. Carp., Penna., 376 Chitteden Ave., Columbus, Ohio 1918
Richards, C. A. J., (Ret.), Asst. Supvr. Strucs., Penna., 422 Gladstone Ave., S.E. Grand Rapids, Mich. 1924
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Rowland, O. F., (Ret.), Asst. Engr., D. & H., c/o Berkshire Industrial Farm, Canaan, N. Y. 1923

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Scheetz, F. B., (Ret.), Asst. Engr., M. P., 3930 Connecticut Ave. N.W., Washington, D. C. 1905
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Smith, C. U., (Ret.), Con. Engr., P. O. Box 955, Lindsay, Calif. 1915
Speaker, D., (Ret.), Mast. Carp., Penna., 813 North Fourth St., Steubenville, Ohio 1928
Stuart, H. B., (Ret.), Struc. Engr., G. T., 4205 Dorchester St., Westmount, P.Q., Can. . . 1913

T

Talbott, J. L., (Ret.), Gen. Fore. B.&B., A. T. & S. F., 228 Park St., Morgantown, W. Va. 1905
Tattershall, E. R., (Ret.), Supvr. of Mtce. Equip., N.Y.C., 21 Coy St., Malone, N. Y. . . 1913

V

Vance, W. H., (Ret.), Asst. Engr. M. of W., M.P., 6347 Alamo Ave., Clayton 5, Mo. . . 1910
Von Schrenk, H., (Ret.), Cons. Tbr. Engr., M. P., 4030 Chouteau Bldg., St. Louis, Mo. . 1916

W

Walden, W. H., (Ret.), Rdm., Southern, 1012 Porter St., Richmond 24, Va. 1920
Warren, L. A., (Ret.), Supvr. B. & B., S.P., 4221 Maple St., Sacramento 17, Calif. . . 1929
Watson, W., (Ret.), Supvr. B.&B., E. J. & E., 304 Leach Ave., Joliet, Ill. 1930
White, F. W., (Ret.), Supvr., B.&B., L.V., 409 So. Wilbur Ave., Sayre, Pa. 1915
White, W. E., (Ret.), Gen. Fore., A.T.&S.F., 706 W. 6th St., Chanute, Kan. 1920
Womeldorf, C. F., (Ret.), Div. Engr., C. & N.W., 111 No. 12th St., Norfolk, Nebr. . . 1917
Wright, C. W., (Ret.), Mast. Carp., L.I., 67 Nassau Pkwy., Oceanside, N. Y. 1908
Wuerth, H., (Ret.), Div. Engr., C.M.St.P.&.., Savanna, Ill. 1919

Z

Zinsmeister, E. C., (Ret.), Mast. Carp., B. & O., 303 - 12th Ave. No., St. Petersburg, Fla. 1905

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A

Allen, J. H., Field Engr., Finishes Div., E.I.DuPont de Nemours & Co., Brian Hill, Malvern, Pa. 1949
Arnold, W. P., Vice Pres. & Gen. Mgr., (Wood Preserving Div.), Koppers Co. Inc. Pittsburgh 19, Pa. 1946

B

Bailey, G. H., Supt. R. R. Div., Morrison-Knudsen Co., 1718 No. 15th St., Boise, Ida. . . 1946
Baker, D. L., Vice Pres. & Treas., Baker & Hickey Co., P.O. Box 5008, Tri Village Sta. Columbus 12, Ohio 1946
Bardwell, A. E., Western Div. Mgr., Fabreeka Products Co., 325 W. Huron St., Chicago 10, Ill. 1946
Bauman, K. F., Vice Pres. - Sls., Warren Tool Corp., Warren, Ohio 1952
Betts, G. R., Mgr. R. R. Sls., Armco Drainage & Metal Prod. Inc., 310 S. Michigan Ave., Chicago, Ill. 1946
Bishop, D. B., Dist. Mgr., Dearborn Chemical Co., 1514 Farmers Bank Bldg., Pittsburgh 22, Pa. 1946
Bolton, J. D., President, John D. Bolton & Co., Gunite Contractor, 910 Custer Ave., Evanston, Ill. 1946
Borcherding, C. H., Dist. Mgr., The Master Bldrs. Co., 2125 Maryland Ave., Baltimore, Md. 1947
Boulton, C. R., R. R. Contractor, 10 E. Town St., Columbus 15, Ohio 1946
Brennon, L. D., M. of W. Repr., Air Reduction Sls. Co., 620 King Dr., Pine Lake Ga. . . 1950
Bryant, C. E. Jr., Johns-Manville Sls. Corp., 22 E. 40th St., New York, N. Y. 1951
Burkey, J. R., Const. Engr., The Union Metal Mfg. Co., 2421 Plymouth Ave., Columbus, Ohio 1942
Burpee, C. M., Vice Pres. Sls. Prom. Serv., Simmons-Boardman Pub. Co. 30 Church St., New York, N. Y. 1930
Buskirk, G. C., Repr., Pacific Coast Borax Co., 5012 Cedar Ave., So. Minneapolis 17, Minn. 1949

C

Canning, J. F., Pres., Southwestern Petroleum Co., Inc., P. O. Box 789, Ft. Worth, Tex. 1949
Clapp, K. J., Asst. Sls. Mgr., Homelite Corp., Port Chester, N. Y. 1946
Clarke, R., Res. Mgr., Massey Concrete Products Co., 111 W. Washington St. Chicago 2, Ill. 1948
Claybaugh, H. S., Div. Engr., Armco Drainage & Metal Prod., Inc., 4345 Lyndale Ave., Minneapolis, Minn. 1946
Clegg, R. R., Dist. Sls. Mgr., American Lumber & Treating Co., 332 So. Michigan Ave., Chicago 4, Ill. 1946
Coburn, M., Service Engr., 4117 Park Ave., Indianapolis 5, Ind. 1946
Colvin, C. M., Ry. Sls. Engr., Armco Drainage & Metal Prod., Inc., 7th & Parker Sts., Berkeley, Calif. 1945
Cross, E. T., Vice Pres., Armco Drainage & Metal Prod. Inc., Middletown, Ohio 1946
Crowe, J. A., Mgr., Bird Tie Pads, Bird & Son, Inc., East Walpole, Mass. 1951

D

Davis, V. W., Mgr., R. R. Sls., Armco Drainage & Metal Prod. Inc., P. O. Box 1343, Atlanta, Ga. 1946
Detzel, G. E., Geo. E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio 1945
Duffie, F. J., Serv. Engr., Oxweld R. R. Serv. Co., 230 No. Michigan Ave., Chicago 1, Ill. 1946

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E

	Joined In
Ehni, C. R., Prod. Engr., The Texas Co., 1511 So. 50th St., Kansas City, Kan.	1950
Ericson, L. T., Ch. Engr., The Jennison Wright Corp., 2463 Broadway, Toledo 1, Ohio	1948
Eschenbrenner, H., Pres., Universal Concrete Pipe Co., 36 Ashbourne Rd., Columbus, Ohio	1946
Evinger, F. W., R. R. Repr., The Patterson Sargent Co., 3243 Euclid Ave., Apt. 2-A, Berwyn, Ill.	1946

F

Farrell, J. I., Sls. Engr., Johns-Manville Sls. Corp., 13 Northern Bldg., Albany, N. Y.	1951
Faylor, J. D., Div. Engr., Armco Drainage & Metal Prod. Inc., 444 Ins. Exchange Bldg., Des Moines, Ia.	1946
Fields, P., Sls. Div., Detroit Graphite Co., 3228 N. Broadway, St. Louis, Mo.	1946
Fix, F., Dist. Sls. Mgr., Transp. Dept., Johns-Manville Sls. Corp., 1530 Guildhall Bldg., Cleveland, Ohio	1946
Filkins, A. J., Pres., Filkins & Son, Co., 9 So. Clinton St., Chicago 6, Ill.	1927
Flannagan, L. F., Detroit Graphite Co., 1500 S. Western Ave., Chicago 8, Ill.	1937
Fletcher, R. L., Struct. Engr., Timber Engineering Co., 1319 18th St., N. W., Washington, D. C.	1947
Flinn, L. E., Sls. & Serv. Repr., Dearborn Chemical Co., Merchandise Mart, Chicago, Ill.	1949
Forshee, R. E., Pres., R. E. Forshee Co., Inc., P. O. Box 416, Newtown, Ohio	1951
Fox, E. A., Dist. Mgr., The Master Bldrs. Co., 80 Boylston St., Boston, Mass.	1951
Frederick, H. Z., Mgr., Ry. Sls. Div., The R. C. Mahon Co., Detroit 34, Mich.	1950

G

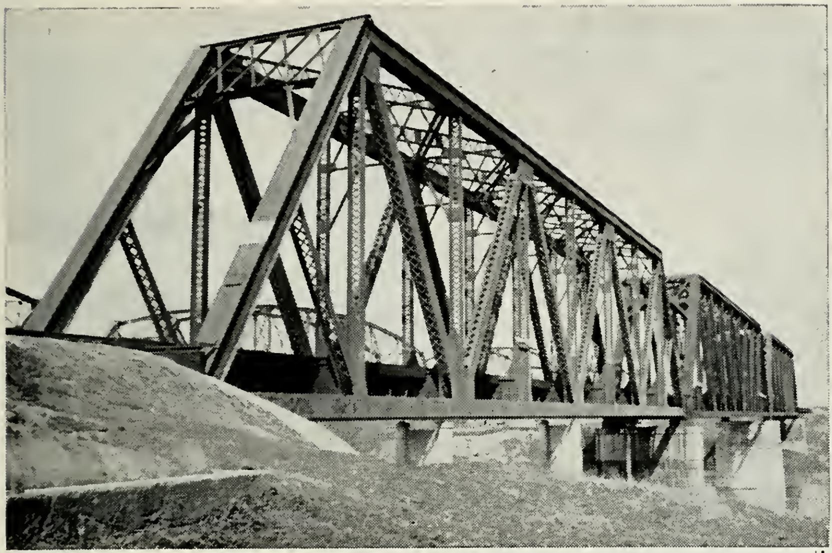
Gibboney, J. L., Vice Pres., Nat'l. Aluminate Corp., 422 No. Dover St., La Grange Park, Ill.	1949
Giles, J. M., Spl. Repr., Off-Track Equip., Caterpillar Tractor Co., Peoria 8, Ill.	1938
Glassgold, I. L., Pres., Masonry Resur. & Con. Co., Inc., B. & O. Coal Pier, Baltimore, Md.	1950

H

Hall, G. E. Jr., Sls. Repr., Johns-Manville Sls. Corp., 270 Madison Ave., New York 16, N. Y.	1951
Hansen, P. O., Mgr. R. R. Sls., Armco Drainage & Metal Prod. Inc., 1516 Keith Bldg., Cleveland 15, Ohio	1952
Hauslein, H. F. W., Harold Hauslein & Associates, (Contractors), 1110 Maple Ave., Evanston, Ill.	1948
Hickey, J. F., Pres., Baker & Hickey Co., P. O. Box 5008, Tri-Village Sta., Columbus 12, Ohio	1946
Hoelzel, W. N., Mgr. R. R. Sls., Gary Screw & Bolt Div., Pittsburgh Screw & Bolt Corp., 122 So. Michigan Ave., Chicago 3, Ill.	1949
Hoffman, T. E., Div. Mgr. & Fire Prot. Supvr., Zone Co., 917 N. Main St., Ft. Worth, Tex.	1949
Holderman, H. L., Sls. Repr., Bird & Son, Inc., 203 S. West Ave., Elmhurst, Ill.	1951
Holmberg, V. V., Ellington Miller, Contractors, 25 E. Jackson Blvd., Chicago 4, Ill.	1942
Holstein, F. W., Mech. Engr., The Rails Co., 115 Observer Hyway., Hoboken, N. J.	1948
Hopkins, W. S. Jr., M. of W. Repr., Air Reduction Sales Co., 60 East 42nd Street, New York 17, N. Y.	1949

J

Jacobson, A. E., Asst. to Mgr., Oxweld R. R. Serv. Co., 230 N. Michigan Ave., Chicago, Ill.	1950
Johnston, H. E., Mgr., No-Ox-Id Dept., Eastern Division, Dearborn Chemical Co., 205 E. 42nd St., New York City 17, N. Y.	1947



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K

Kalinka, J. E., Vice Pres., Roberts & Schaefer Co., 130 No. Wells St., Chicago 6, Ill. . . . 1946
Kiester, R. S., Slsman., Pacific Borax Co., 503 Southern Standard Bldg., Houston 2, Tex. 1950
Kirk, M. G., Salesman, Pittsburgh Screw & Bolt Corp., P. O. Box 1708, Pittsburgh 30, Pa. . . . 1948
Kluiber, F. C., John Bean Div., Food Machine & Chemical Corp., Lansing, Mich. . . . 1952

L

Lacey, J. W., Serv. Engr., The Oxweld R. R. Serv. Co., 230 No. Mich. Ave., Chicago 1, Ill. . . . 1946
LeDuc, C. L., Field Sls. Mgr., The Acorn Refining Co., Suite 1310 - 109 No. Wabash Ave., Chicago 2, Ill. . . . 1946
Lee, R. H., Pres., Geo. Vang, Inc., 623 Grant Bldg., Pittsburgh 19, Pa. . . . 1951
Leypoldt, F., Jr., Pres., Carbolineum Wood Preserving Co., 528 W. Highland Ave., Milwaukee 3, Wis. . . . 1945
Lipscomb, W. P., Mgr., R. R. Sls., Armco Drainage & Metal Prod., Inc., 3524 Plumb St., Houston 5, Tex. . . . 1951
Littleton, E. J., Mgr. R. R. Sls., Jennison-Wright Corp., Granite City, Ill. . . . 1949
Lockart, E. P., Mgr., Glass Blck Sls., American Structural Products Co., P. O. Box 1035 - 36, Toledo, Ohio . . . 1951
Luther, L. A., Serv. Engr., Ingersoll Rand Co., 1121 Hamilton Ave., Palo Alto Calif. . . . 1945
Lynch, J. K., Sls. Engr., Massey Concrete Products Co., 3431 - 27th Ave. No., Birmingham, Ala. . . . 1951
Lyon, C. A., Reg. Mgr., Master Builders Co., 104 W. Huron St., Ann Arbor, Mich. . . . 1945

Mc

McDaniel, W. L., Vice Pres., Massey Concrete Prod. Co., 111 W. Washington St., Chicago 2, Ill. . . . 1945
McFadden, E. C., Dist. Mgr., Pittsburgh Pipe Cleaner Co., 11110 Longwood Dr., Chicago 43, Ill. . . . 1945
McFarland, M., Sls. Dept., E. I. Du Pont de Nemours Co., 1616 Walnut St., Philadelphia, Pa. . . . 1952
McGehee, E. J., Vice Pres., Koppers Co., Inc., 122 So. Michigan Ave., Chicago 3, Ill. . . . 1946
McVay, G. R., Mgr. R. R. Sls. Div., The Ruberoid Co., 30 N. Michigan Ave., Chicago 1, Ill. . . . 1937

M

Mabry, D. B., Mgr. Lmbr. Sls., T. J. Moss Tie Co., 700 Security Bldg., St. Louis, Mo. . . . 1948
Mann, E. A., Pres., Champion Transportation Sls., Inc., 222 W. Adams St., Chicago 6, Ill. . . . 1951
Maurer, S. S., Western Div. Mgr., Fabreeka Prod. Co., 325 W. Huron St., Chicago 10, Ill. . . . 1952
Mayfield, P. B., Tech. Cons., Barrett Div., Allied Chem. & Dye Corp., 40 Recter St., New York 6, N. Y. . . . 1950
Mero, C. V., Mastercraft Tile & Roofing Co., No. 1 - 20th St., Richmond Calif. . . . 1949

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Meyer, F. J., Ch. Engr., Ry. Prod. Div., Phila. Steel & Wire Corp., 80 E. Jackson Blvd., Chicago 4, Ill. 1948
Miller, J. W., Pres., W. M. Corp., 608 S. Dearborn St., Chicago 5, Ill. 1946
Minton, J. H., The Minton Const. Co., 3751 Prospect Ave., Cleveland 15, Ohio 1946
Montgomery, H., Dist. Mgr., The Master Builders Co., 2159 Bay St., Los Angeles, Calif. 1946
Morris, G. J., Supvr. Serv., Electric Tamper & Equipment Co., P. O. Box 5, Cambridge, Ohio 1948
Morton, H. M., Sls. Engr., Johns-Manville Co., 1267 Architects Bldg., Los Angeles, Calif. 1945
Myers, D. R., Sls. Repr., R. R. Sls., Patterson Sargent Co., 1882 S. Normal Ave., Chicago 16, Ill. 1952

N

Needham, L. H., Pres., The Penetryn System, Inc., 2294 Scranton Rd., Cleveland Ohio . . 1946

P

Paris, G. H., R. R. Repr. Strl. & Rys. Bur., Portland Cement Assn. 33 W. Grand Ave., Chicago 10, Ill. 1945
Patterson, R., Vice Pres., Intrusion Prepakt, Inc., 80 E. Jackson Blvd., Chicago 4, Ill. . . . 1946
Patton, R. C., Tech. Adviser, Libby Zone Co., 731 E. Kingston Ave., Charlotte, N. C. . . 1952
Powers, D. D., Sls. Engr., Dearborn Chemical Co., 1101 Union Central Bldg. Cincinnati 2, Ohio 1947

R

Redding, G. H., Pres., Massey Concrete Prod. Co., 111 W. Washington, Chicago 2, Ill. 1946
Ruhl, D. A., Constr. Mgm't. Engr., Corps of Engrs., U. S. A., 11142 S. Bell Ave., Chicago 43, Ill. 1948
Ryan, P. H., Sls. Engr., Southern Amiesite Asphalt Co., P. O. Box 1390, Birmingham, Ala. 1952

S

Scott, J. M., Sls., The Arco Co., 614 Delaware St., Scranton 9, Pa. 1945
Shoop, J. W., Vice Pres., The Lehon Company, 4425 S. Oakley Ave., Chicago 9, Ill. 1945
Smith, F. C., R. R. Fire Prot. Engr., Marsh & McLennan, Inc., 231 S. La Salle St., Chicago 4, Ill. 1948
Smith, W. T., Gen. Supt., Geo. E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio 1950
Snow, B. S., Pres., T. W. Snow Constr. Co., R. R. Supplies, 10 W. Wilson St., Batavia, Ill. 1946
Southwick, C. E., Factory Repr., Homelite Corp., 624 S. Anderson, Los Angeles 23, Calif. 1945
Spietz, A. L., Pres., Interstate General Contractors, Inc., 5621 N. Glenwood Ave., Chicago 40, Ill. 1950
Spietz, W. P., Monarch Painting Serv., 5621 N. Glenwood Ave., Chicago 40, Ill. 1950
Stierer, G. W., Mgr. Struct'l. Steel Dept., Robt. W. Hunt. Co., 175 W. Jackson Blvd., Chicago 4, Ill. 1946

T

Thompson, N., Vice Pres., Homelite Corp., Port Chester, N. Y. 1946
Tracy, R. N., Mgr. R. R. Sls., Armco Drainage & Metal Prod. Inc., Box 2170, Denver 1, Colo. 1946
Truss, F. W., Mgr. R. R. Sls., Armco Drainage & Metal Prod. Inc., 817 Ambassador Bldg., St. Louis 1, Mo. 1946
Twomey, J. F., Vice Pres., McCracken Contracting Co., 7340 S. Western Ave., Chicago, Ill. 1948

U

Utley, O. H., Vice Pres., The Zone Co., 917 N. Main St., Ft. Worth, Tex. 1949

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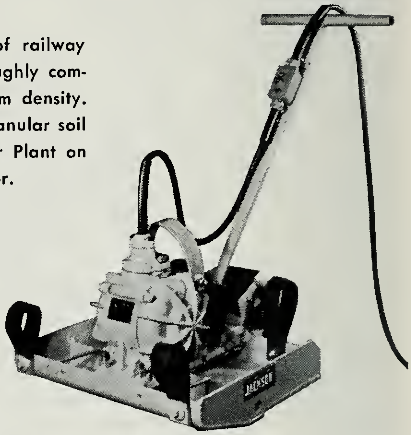

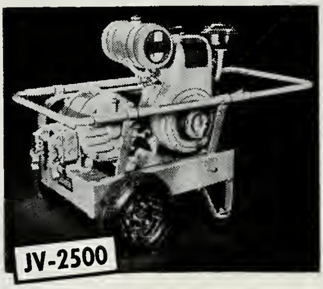

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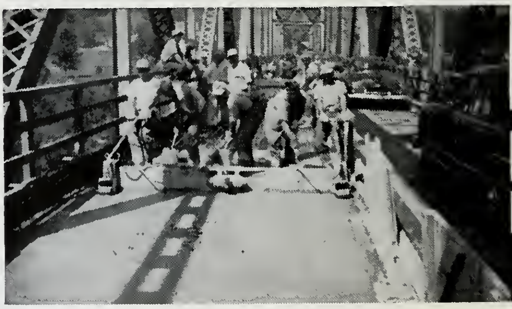

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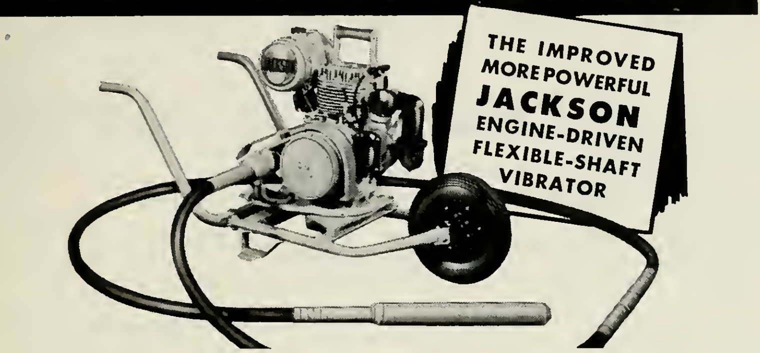

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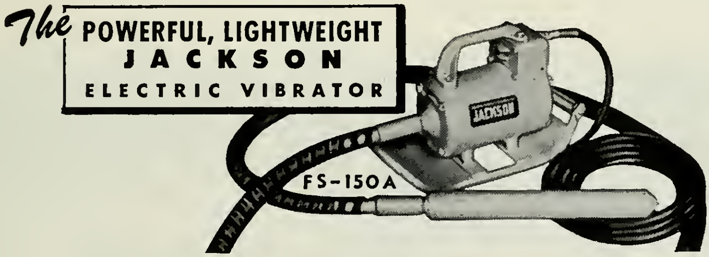

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V

Vanden Boom, R. G., Pres., Pacific Union Metal Co., 3248 Long Beach Ave., Los Angeles, Calif. 1946

W

Walters, W. R., Gen. Mgr., Ry. Ballast Cond. Corp., 1535 Rand Tower, Minneapolis, Minn. 1949
Weir, K. J., W-M Corporation, 608 S. Dearborn St., Chicago 5, Ill. 1940
Wilson, W. C., Sls. Engr., Ralph W. Payne Co., Nat'l. Met. Bk. Bldg., Washington D. C. 1951
Winters, F. T., Jr., Mgr., Agricultural Sls. Div., Pacific Coast Borax Co., P. O. Box 9128, Station "S", Los Angeles 5, Calif. 1949
Wood, B. R., Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio 1937

Y

Young, R. W., Jr., R. W. Young Mfg. Co., 20 No. Wacker Dr., Chicago 6, Ill. 1946

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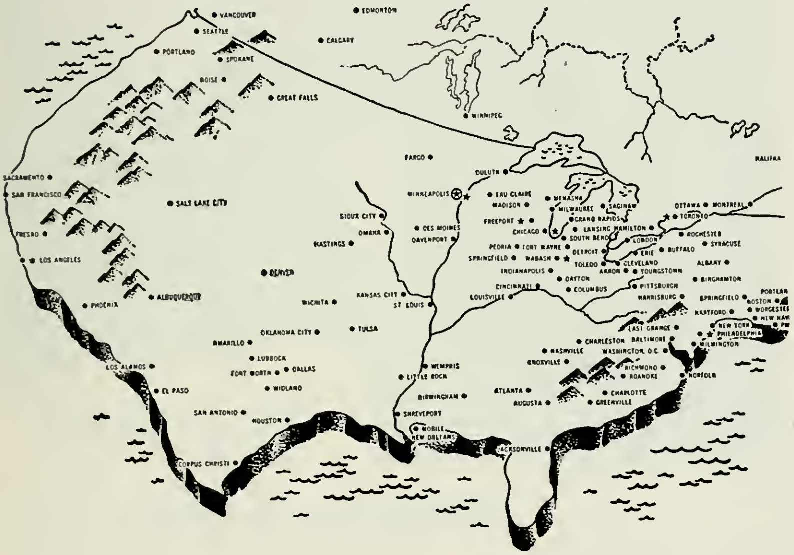

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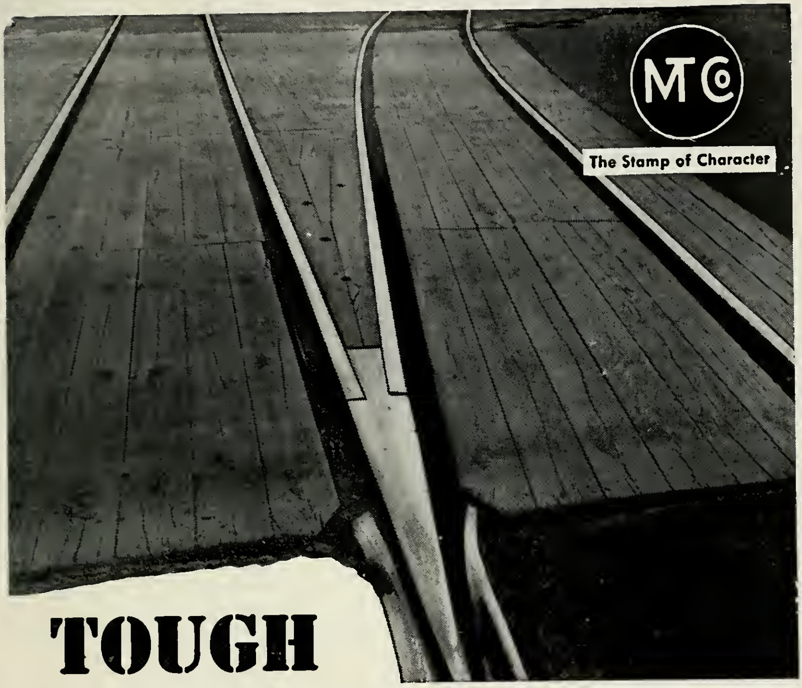

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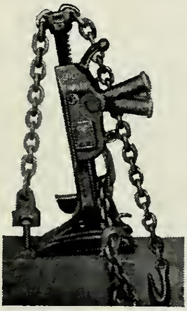

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No.	Place of Meeting	Date	Membership
1	St. Louis, Mo.	Sept. 25, 1891	60
2	Cincinnati, Ohio	Oct. 18-19, 1892	112
3	Philadelphia, Pa.	Oct. 17-19, 1893	128
4	Kansas City, Mo.	Oct. 16-18, 1894	115
5	New Orleans, La.	Oct. 15-16, 1895	122
6	Chicago, Ill.	Oct. 20-22, 1896	140
7	Denver, Colo.	Oct. 19-21, 1897	127
8	Richmond. Va.	Oct. 18-19, 1898	148
9	Detroit, Mich.	Oct. 17-19, 1899	148
10	St. Louis, Mo.	Oct. 16-18, 1900	143
11	Atlanta, Ga.	Oct. 15-17, 1901	171
12	Minneapolis, Minn.	Oct. 21-23, 1902	195
13	Quebec, Canada	Oct. 20-22, 1903	223
14	Chicago, Ill.	Oct. 18-20, 1904	293
15	Pittsburgh, Pa.	Oct. 17-19, 1905	313
16	Boston, Mass.	Oct. 16-18, 1906	340
17	Milwaukee, Wis.	Oct. 15-17, 1907	341
18	Washington, D. C.	Oct. 20-22, 1908	368
19	Jacksonville, Fla.	Oct. 19-21, 1909	393
20	Denver, Colo.	Oct. 18-20, 1910	428
21	St. Louis, Mo.	Oct. 17-19, 1911	499
22	Baltimore, Md.	Oct. 15-17, 1912	524
23	Montreal, Quebec	Oct. 21-23, 1913	570
24	Los Angeles, Cal.	Oct. 20-22, 1914	586
25	Detroit, Mich.	Oct. 19-21, 1915	665
26	New Orleans, La.	Oct. 17-19, 1916	710
27	Chicago, Ill.	Oct. 16-18, 1917	704
28	Chicago, Ill.	Oct. 15-17, 1918	716
29	Cleveland, Ohio	Oct. 21-23, 1919	776
30	Atlanta, Ga.	Oct. 26-28, 1920	840
31	New York, N.Y.	Oct. 18-20, 1921	850
32	Cincinnati, Ohio	Oct. 17-19, 1922	865
33	Seattle, Wash.	Oct. 16-18, 1923	846
34	Kansas City, Mo.	Oct. 21-23, 1924	837
35	Buffalo, N.Y.	Oct. 20-22, 1925	759
36	Richmond, Va.	Oct. 12-14, 1926	750
37	Minneapolis, Minn.	Oct. 18-20, 1927	754
38	Boston, Mass.	Oct. 23-25, 1928	755
39	New Orleans, La.	Oct. 15-17, 1929	755
40	Louisville, Ky.	Oct. 21-23, 1930	713
41	Chicago, Ill.	Oct. 16-18, 1934	592
42	Chicago, Ill.	Oct. 15-17, 1935	547
43	Chicago, Ill.	Oct. 20-22, 1936	588
44	Chicago, Ill.	Oct. 19-21, 1937	566
45	Chicago, Ill.	Oct. 18-20, 1938	589
46	Chicago, Ill.	Oct. 17-19, 1939	546
47	Chicago, Ill.	Oct. 15-17, 1940	610
48	Chicago, Ill.	Oct. 14-16, 1941	594
49	Chicago, Ill.	Oct. 20-22, 1942	618
50	Chicago, Ill.	Oct. 20-21, 1943	597
51	Chicago, Ill.	Sept. 17-19, 1946	698
52	Chicago, Ill.	Sept. 16-18, 1947	651
53	Chicago, Ill.	Sept. 20-22, 1948	652
54	Chicago, Ill.	Sept. 12-14, 1949	676
55	Chicago, Ill.	Sept. 18-20, 1950	713
56	Chicago, Ill.	Sept. 17-19, 1951	676
57	Chicago, Ill.	Sept. 15-17, 1952	667

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The right photo shows a completed Libbey-ZONE application to a typical wood trestle. The white surface is simple, inexpensive gravel aggregate held in place by the Libbey-ZONE coating. Practically fireproof.

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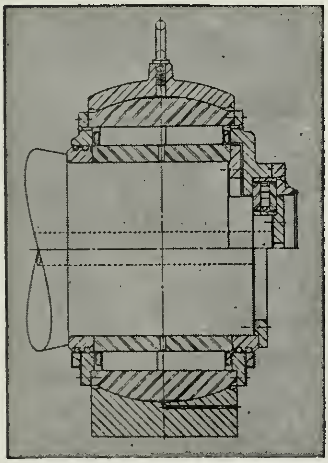

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